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**Young Seon Kim, Jin Ah Ryuk, Byoung Seob Ko. Discrimination of korean Rehmannia glutinosa from chinese Rehmannia glutinosa using sequence-characterized amplified region marker. J. Korean Soc. Appl. Biol. Chem. 55(1):1-6**

Rehmanniae Radix, from the roots of Rehmannia glutinosa Libosch has been used in traditional herb medicine for the treatment of fever and strengthening liver function, among others. Information on the phylogenetic relationship is very limited in the region of its cultivation. It is very important to know the information of the close relatives of R. glutinosa Libosch and R. glutinosa Libosch. f. hueichingensis Hsiao, R. glutinosa produced in Wen County, Meng County, Bo’ai County, Qinyang County in Henan province, China. In this study, we examined the polymorphism analysis of Rehmanniae Radix originated from both Korea and China to compare the difference at the genomic DNA level. Results revealed that ITS and rps16 region sequences of R. glutinosa in Korea and R. glutinosa in China were correspond, while randomly amplified polymorphic DNA analysis showed a difference in UBC 301 primer. The specific primer designed was amplified at 334 bp for R. glutinosa originated from China. This primer (HRgF and HRgR) would be used efficiently to distinguish R. glutinosa from different sources.

**Hyun Cheol Jeong, Wan-Taek Ju, Kyung-Hyun Jo, Ro Dong Park. Purification and characterization of a 34-kDa chitobiosidase from Aeromonas sp. GJ-18. J. Korean Soc. Appl. Biol. Chem. 55(1):7-12**

Chitobiosidase was purified and characterized from Aeromonas sp. GJ-18 by ammonium sulfate precipitation, anion-exchange chromatography, and gel filtration chromatography. The purified enzyme has a molecular weight of 34 kDa on sodium dodecyl sulfate-polyacrylamide gel electrophoresis. The enzyme showed an optimum pH and temperature of 6.0 and 30–50°C, respectively. The enzyme was stable at pH 5–8 and 50°C and was completely inhibited in the presence of 10 mM Zn2+ ions. The enzyme could efficiently hydrolyze colloidal chitin into N,N′- diacetylchitobiose as the major product, indicating that the purified enzyme is a chitobiosidase. When colloidal chitin was used as the substrate, the K m and V max of this enzyme were established as 3.45 mg/mL and 2.91 μmol/min, respectively.

**Kyunghwa Hwang, Sun-Sook Song, Ju-Hee Lee, Min-Chul Shin, Jong-Su Seo. Development and validation of an LC/MS/MS method for determination of valproic acid and its metabolite 2-propyl-4-pentenoic acid in monkey plasma. J. Korean Soc. Appl. Biol. Chem. 55(1):13-17**

A rapid, accurate, and sensitive liquid chromatography/mass spectrometry (MS)/MS method for the quantitative determination of valproic acid (VPA) and its metabolite, 2-propyl-4-pentenoic acid (4-ene VPA), in monkey plasma was developed and validated. The sample extraction was performed using hydrophilic-lipophilic balance cartridge. The analytes were separated on a Kinetex C18 (2.1 mm × 100 mm, 2.6 μm) analytical column under a mobile phase consisting of 10 mM ammonium formate (pH 8.0)/methanol (20/80, v/v) and isocratic flow at 0.15 mL/min. The tandem mass spectrometer was operated in negative electrospray ionization with selected ion monitoring conditions, 143.0, 141.0, and 121.0 for VPA, 4-ene VPA, and benzoic acid (internal standard), respectively. The linearity of calibration curve ranging from 0.1 to 20 μg/mL was at least 0.9996 (coefficient of correlation, r) for both analytes. Intra- and inter-day precisions for both analytes were lower than 15%, resulting from quality control (QC) samples at concentration of 0.2 (low QC), 1.6 (middle QC), and 16 (high QC) μg/mL except at the lower limit of quantification (LLOQ) (0.1 μg/mL) level, which was less than 20%. The intra- and inter-day accuracies were within ±15%. The recoveries were 84.4–90.8% for VPA and 88.2–100.6% for 4-ene VPA. Both analytes were stable throughout short-term temperature, post preparation for 24 h, and three freeze/thaw cycles, validating that this method could be applied to toxicokinetic and pharmacokinetic studies.

**Hoon Choi, Joon-Kwan Moon, Byeoung-Soo Park, Hee-Won Park, So-Young Park, Tae-San Kim, Dong-Hern Kim, Tae-Hun Ryu, Soon-Jong Kweon, Jeong-Han Kim. Comparative nutritional analysis for genetically modified rice, Iksan483 and Milyang204, and nontransgenic counterparts. J. Korean Soc. Appl. Biol. Chem. 55(1):19-26**

Recently, two glufosinate-tolerant rice varieties, Iksan483 and Milyang204, were developed in Korea generated by adding bar gene to genomes of the conventional rice varieties. Comparative assessment of nutritional composition was conducted with genetically modified rice grains and its conventional counterparts for substantial equivalence. Nutrients including proximates, fatty acids, amino acids, minerals, vitamins, and antinutrients were investigated using several statistical comparisons. The results showed that, except for small differences in a few fatty acids, minerals, and trypsin inhibitor, there was no significant difference between genetically modified rice and conventional counterpart variety with respect to their nutrient composition. Most of measured levels of nutrients were in good compliance with the literature ranges, showing substantial equivalency. The results of principle component analysis demonstrated that the environment affects the nutritional composition and that all differences between the genetically modified and conventional rice varieties are within the range as the differences observed among conventional varieties grown in different years. Therefore, the insertion of bar gene did not change the nutritional composition of genetically modified rice grains.

**Yong Kyoung Kim, Tae Jin Yang, Soo-Un Kim, Sang Un Park. Biochemical and molecular analysis of Ginsenoside biosynthesis in Panax ginseng during flower and berry development. J. Korean Soc. Appl. Biol. Chem. 55(1):27-34**

Panax ginseng produces a large number of ginsenosides throughout the parts of the ginseng plant. Several genes in the ginsenoside biosynthesis pathway were cloned, including those encoding farnesyl diphosphate synthase, squalene synthase, squalene epoxidase, dammarenediol-II synthase, lanosterol synthase, β- amyrin synthase, and cycloartenol synthase. The expression levels of these seven genes were examined in the roots and different developmental stages of the flowers and berries of 4-year-old ginseng plants using quantitative real-time polymerase chain reaction. The levels of ten ginsenosides (Rb1, Rb2, Rb3, Rc, Rd, Re, Rf, Rg1, Rg2, and Rh1) were determined by high performance liquid chromatography analysis. Gene expression varied during flower and berry development. Total saponin levels were highest in the early berry stage and correlated well with those in the ginseng root. Therefore, berries should be harvested at the early berry stage to ensure optimal ginsenoside levels for pharmaceutical interest.

**Ju-Hyun Jeon, Min-Seok Oh, Kyoung-Shik Cho, Hoi-Seon Lee. Phototactic response of the rice weevil, Sitophilus oryzae linnaeus (Coleoptera: Curculionidae), to light-emitting diodes. J. Korean Soc. Appl. Biol. Chem. 55(1):35-39**

The phototactic response of the rice weevil, Sitophilus oryzae (L.), to light-emitting diodes (LEDs) at five different wavelengths and various light intensities was tested in an LEDequipped Y-maze chamber, and compared with its response to a luring lamp, which is used in commercial traps. Blue (84.3%) was the wavelength most attractive to S. oryzae, followed by green (74.3%), red (64.3%), UV (63.3%), and IR (48.7%). Moreover, blue and green wavelengths were 1.5 and 1.3 times more attractive than luring lamp (56.7%), whereas the UV wavelength was slightly less attractive to the weevils than luring lamp. These results suggested that blue and green wavelengths could be more useful than those currently used for monitoring and mass trapping of S. oryzae.

**Jin Mi Chun, Myeong Sook Cheon, Mikyung Park, A. Yeong Lee, Byeong Cheol Moon, Yunui Ji, Ho Kyoung Kim. Inhibitory effects of an ethyl acetate fraction from Cephalonoplos segetum on inflammatory mediators from lipopolysaccharide-induced RAW 264.7 macrophages. J. Korean Soc. Appl. Biol. Chem. 55(1):41-46**

Cephalonoplos segetum has been used as an herbal remedy, and is considered to have anti-inflammatory potential. However, its biological mechanism in this treatment process remains unknown. Therefore, the anti-inflammatory activity of the ethyl acetate fraction of C. segetum extracts (CSE-EA), more active than C. segetum extracts (CSE) in murine macrophages, was investigated. Production levels of nitric oxide (NO), prostaglandin E2 (PGE2), tumor necrosis factor-α (TNF-α), and interleukin-1β (IL-1β) by lipopolysaccharide (LPS)-induced RAW 264.7 macrophages were measured by ELISA. In addition, protein expression levels of inducible NO synthase (iNOS) and cyclooxygenase (COX)-2, and the phosphorylation of mitogenactivated protein kinases (MAPKs) in the LPS-induced macrophages were investigated by Western blotting. The CSE-EA (50, 100 or 200 μg/mL) significantly inhibited NO, PGE2, TNF-α, and IL-1β production in LPS-induced macrophages in a dose-dependent manner with 50% inhibitory concentration values of 80.4, 104.7, 91.3, and 46.7 μg/mL, respectively. Similarly, CSE-EA reduced protein expression of iNOS and COX-2 and led to the attenuated activation of kinases ERK1/2 and JNK in the macrophages. Results of the present study suggest that the anti-inflammatory effects of CSE-EA are likely due to the down-regulation of NO, PGE2 TNF-α, and IL-1β and the reduced expression of iNOS and COX-2 via suppression of MAPK signaling pathways in LPS-induced murine macrophages.

**Eun-Young Jeong, Kyoung-Shik Cho, Hoi-Seon Lee. α-amylase and α-glucosidase inhibitors isolated from Triticum aestivum L. sprouts. J. Korean Soc. Appl. Biol. Chem. 55(1):47-51**

Inhibitory activities of the methanol extract from Triticum aestivum L. sprouts were examined against α-amylase and α-glucosidase. The active constituents of T. aestivum were isolated by chromatographic techniques and identified as γ-aminobutyric acid and ferulic acid on the basis of IR and NMR. γ-Aminobutyric acid and ferulic acid showed the high inhibitory activities with IC50 values of 5.4±0.2 and 9.5±0.1 mM against α-amylase, and 1.4±0.4 and 4.9±0.3 mM against α-glucosidase. The methoxy group on the hydroxycinnamic acid of ferulic acid derivatives played important functions in the α-amylase and α-glucosidase inhibitory activities. Based on the IC50 values of nitrite-scavenging activity, ferulic acid (98±3.9 μg/mL) was the most effective constituent, followed by γ-aminobutyric acid (182± 4.2 μg/mL), sinapic acid (301±2.7 μg/mL), and p-coumaric acid (454±2.2 μg/mL). These results indicate that γ-aminobutyric acid and ferulic acid could be useful as preventative agents, and possibly therapeutic modalities for the treatment of metabolic diseases.

**Ji-Won Yang, Sang Yoon Choi, Soo-Jin Park, Nam-Soo Paek, Sung Soo Kim. Anti-Helicobacter Pylori effect of fermented ginseng extracts with Lactobacillus plantarum MG 208. J. Korean Soc. Appl. Biol. Chem. 55(1):53-56**

Water extract of ginseng was fermented using various lactic acid bacteria, and their anti-Helicobacter pylori activity was evaluated. The fermented ginseng extracts evidenced anti-H. pylori activity, including anti-bacterial, anti-adhesion, and urease inhibition effects. Among the four types of lactic acid bacteria, Lactobacillus plantarum MG 208 evidenced the most profound anti-H. pylori activity in fermented ginseng. Therefore, fermented ginseng extract containing L.plantarum MG 208 could prove useful as functional diet for the protection of the gastric environment against H. pylori.

**Soo-Hyun Park, Yun-Beom Sim, Seon-Mi Kim, Yu-Jung Kang, Jin-Koo Lee, Hong-Won Suh. Antinociceptive profiles and mechanisms of orally administered curcumin in various pain models. J. Korean Soc. Appl. Biol. Chem. 55(1):57-61**

Antinociceptive profiles of curcumin in ICR mice were examined. Curcumin administered orally (from 1 to 10 mg/kg) showed an antinociceptive effect in a dose-dependent manner as measured in the acetic acid-induced writhing test. Duration of antinociceptive action of curcumin was maintained at least for 60 min. Moreover, cumulative response time of nociceptive behaviors induced with intraplantar formalin injection was reduced by curcumin treatment during second phase. Cumulative nociceptive response time for intrathecal injection of substance P (0.7 μg) or glutamate (20 μg) was diminished by curcumin. Intraperitoneal pretreatment with naloxone (opioid receptor antagonist) or methysergide (5-HT serotonergic receptor antagonist)-attenuated antinociceptive effect induced by curcumin in the writhing test, whereas yohimbine (α2-adrenergic receptor antagonist) did not affect antinociception induced by curcumin, suggesting that curcumin shows antinociceptive property in various pain models, and this antinociceptive effect of curcumin may be mediated by opioidergic and serotonergic receptors, but not α2-adrenergic receptor.

**Eun-Kyung Ahn, Joa Sub Oh. Inhibitory effect of galanolactone isolated from Zingiber officinale roscoe extract on adipogenesis in 3T3-L1 cells. J. Korean Soc. Appl. Biol. Chem. 55(1):63-68**

Zingiber officinale Roscoe commonly known as ginger, has been used in traditional medicine. Inhibtion effect of galanolactone isolated from Z. officinale Roscoe on adipogenesis in 3T3-L1 cells was evaluated. Effect of galanolactone on 3T3-L1 adipocyte differentiation was measured by Oil Red O staining, and cytotoxicity effect of galanolactone was analyzed by 3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyltetrazolium bromide assay. The expression of various genes involved in adipogenic action of galanolactone was determined by real-time PCR and Western blot. Peroxisome proliferator-activated receptor γ (PPARγ) luciferase transactivation assay was used to evaluate the PPARγ transcriptional activity of galanolactone in HEK 293T cells. Galanolactone inhibited lipid accumulation and expression of adipocyte fatty acid-binding protein (aP2) and resistin in a dose-dependent manner in 3T3-L1 cells. Treatment with 50 and 100 μM of galanolactone significantly decreased the troglitazone-induced PPARγ transcripitional activity in HEK 293T cells, and suppressed expressions of PPARγ and CCAAT-enhancer-binding protein α (C/EBPα) at mRNA and protein levels in 3T3-L1 cells. These findings suggest that galanolactone isolated from Z. officinale Roscoe exerts anti-obesity effect through downregulation of adipogenic transcription factors and adipogenic marker genes.

**Seong Su Hong, Joa Sub Oh. Inhibitors of antigen-induced degranulation of RBL-2H3 cells isolated from wheat bran. J. Korean Soc. Appl. Biol. Chem. 55(1):69-74**

Chromatographic separation of ethanol extract of wheat bran led to the isolation of five 5-alk(en)ylresorcinols, four aliphatic compounds, and one phenolic glycoside. These were, respectively: 5-n-heptadecylresorcinol (**1**), 5-n-14′-(Z)-heneicosylresorcinol (**2**), 5-n-nonadecylresorcinol (**3**), 5-n-heneicosylresorcinol (**4**), 5-n-tricosylresorcinol (**5**), 1-O-(9Z,12Z,15Z-octadecatrienoate) glycerol (**6**), 2-linoleoylglycerol (7), 1-O-(9Z,12Z-octadecatrienoate)glycerol (**8**), pinellic acid (**9**), and tachioside (**10**). Their structures were determined by 1D- & 2D-NMR and mass spectroscopy data analysis. The inhibitory effects of isolated constituents on the release of β-hexosaminidase from RBL-2H3 cells were examined. Inhibition was shown by 5-n-nonadecylresorcinol (**3**), 5-n-heneicosylresorcinol (**4**), pinellic acid (**9**), and tachioside (**10**).

**Jung-Hee Kim, Heejong Kim, Yesol Bak, Jeong-Woo Kang, Dong Hun Lee, Man Sub Kim, Yun Sun Park, Eun-Jin Kim, Kang-Yeoun Jung, Yoongho Lim, Jintae Hong, Do-Young Yoon. Naringenin derivative diethyl (5,4′-dihydroxy flavanone-7-yl) phosphate inhibits cell growth and induces apoptosis in A549 human lung cancer cells. J. Korean Soc. Appl. Biol. Chem. 55(1):75-82**

Anti-cancer effects of naringenin derivative diethyl (5,4′-dihydroxy flavanone-7-yl) phosphate were evaluated in human lung cancer cells. The effect of diethyl (5,4′-dihydroxy flavanone-7-yl) phosphate (dEdHF-7-p) on A549 cell viability was measured using MTS assay and cell counting. Morphological changes were detected using phase-contrast microscopy. Apoptosis was analyzed using Hoechst staining. The influence of dEdHF-7-p on cell cycle distribution was determined using propidium iodide (PI) staining, and protein expression was determined by Western blot analysis. A newly synthesized naringenin derivative dEdHF-7-p suppressed cell growth of A549 though mechanisms including inhibition of cell cycle and increased apoptosis. Apoptotic and cell cycle modulators were changed by dEdHF-7-p in A549 cells; cyclins, ppRB, and antiapoptotic factor Bcl-2 were down-regulated, whereas apoptotic factor Bax and cyclin-dependent kinase inhibitors p21 and p53 were enhanced, thereby releasing cytochrome c into the cytosol of dEdHF-7-p -treated-A549 cells. dEdHF-7-p treatment processed caspases-3/-8/-9 and cleavage of poly ADP-ribose polymerase. The dEdHF-7-p treatment enhanced Fas expression and decreased expression of cell survival factors such as PI3K and p-Akt in a dose-dependent manner. Taken together, dEdHF-7-p induces apoptosis by inhibiting the PI3K/Akt survival signaling pathway and modulating mitochondria-emanated intrinsic and Fas extrinsic pathways in A549 cells.

**Sunhwa Park, Ji-Young Ryu, Jiyoung Seo, Hor-Gil Hur. Isolation and characterization of alkaliphilic and thermotolerant bacteria that reduce insoluble indigo to soluble leuco-indigo from indigo dye vat. J. Korean Soc. Appl. Biol. Chem. 55(1):83-88**

Indigo dye has been used in the textile dye industry for long period. Insoluble indigo are reduced to soluble leuco-indigo before dying textiles. A traditional process for solubilization of indigo using microbial reduction metabolism has been considered as environmentally benign method and as alternative to faster chemical reactions. Thus, fermentation liquor aged for 6 years with Polygonum tinctorium (indigo plant) extracts was used to isolate bacteria able to reduce insoluble indigo. Two bacterial isolates, A1 and G5, showed indigo-reducing activity, and were identified as Alkalibacterium sp. and Pseudomonas sp. respectively, with 99% sequence similarity by 16S rDNA sequence analyses. Based on the concentrations of leuco-indigo reduced from indigo, Alkalibacterium sp. A1 and Pseudomonas sp. G5 showed alkaliphilic and thermotolerant charactertistics, optimally functioning at pH 10.0 and 50°C. Isolation of alkaliphilic and thermotolerant bacterial strains, which can reduce insoluble indigo into leuco-indigo, from Korean traditional fermentation liquor could provide a biological tool to enhance efficiency in the traditional indigo dye by an environmentally friendly manner.

**Ju Yeon Park, Si Young Yang, Young Cheol Kim, Jin-Cheol Kim, Quang Le Dang, Jeong Jun Kim, In Seon Kim. Antiviral peptide from Pseudomonas chlororaphis O6 against tobacco mosaic virus (TMV). J. Korean Soc. Appl. Biol. Chem. 55(1):89-94**

Although Pseudomonas chlororaphis O6 (O6) is known to be a rhizobacterium capable of inducing systemic resistance against plant virus, its antiviral products from O6 remain unknown. In the present study, an antiviral cyclic peptide was identified from the cell-free supernatant of O6. O6 cultures grown on Luria Bertani medium were centrifuged, and the resulting supernatant was extracted with organic solvent, followed by a series of column chromatography and preparative high performance liquid chromatography (HPLC). Bioassay-guided fractionations were involved in the isolation of antiviral products against tobacco mosaic virus (TMV). Time of flight mass spectrometry (TOF-MS) analysis of the isolated product detected (M+H)+ peak at m/z 887.4242 that generated m/z 756.3859, 657.3180, 556.2724, 459.2208, 345.1873, and 171.1130 as the main fragment ions. NMR analyses characterized all protons and carbons of the isolated product. Based on the data, the isolated antiviral product was determined to be a cyclic peptide with molecular formula C39H67N9O12S consisting of seven different amino acids. The antiviral peptide exhibited more than 95% disease suppression of TMV at 1,000 μg/mL. O6 may play a role in promoting plant growth.

**Eunhye Kim, Joon-Kwan Moon, Hoon Choi, Su-Myoung Hong, Dong-Hyuk Lee, Hyomin Lee, Jeong-Han Kim. Exposure and risk assessment of insecticide methomyl for applicator during treatment on apple orchard. J. Korean Soc. Appl. Biol. Chem. 55(1):95-100**

Exposure and risk assessments were conducted to evaluate safety of speed spayer (SS) and power sprayer (PS) used for treatment of insecticide methomyl in apple orchard on the operator. Dermal patches, gloves, socks, and masks were used to monitor the potential dermal exposure, and personal air monitor with XAD-2 resins was used to evaluate the potential inhalation exposure. Validation of methods for limit of detection, limit of quantitation, recovery, reproducibility, linearity of calibration, trapping efficiency, and breakthrough tests were performed to obtain reasonable results for quantitative exposure study of methomyl. During application of methomyl, PS resulted in more dermal exposure than SS. Important contaminated parts of body were upper arms, thigh, chest, shin, hand, forearm, and head for both SS and PS. Exposure rate was 44–176 mL/h. Although the level of inhalation exposure was very low during application, relatively higher level was observed for PS than for SS. During mixing/loading, more dermal exposure occurred by SS than that of PS probably due to drift of wettable powder (WP) formulation. Exposure was mostly observed on hand, and 99.9% of hand exposure to soluble liquid formulation (215 mg) in PS was from spill of liquid formulation on gloves. However, the body exposure ratio to total mixing/loading amount and inhalation exposure during mixing/loading was very low. Margin of safety in risk assessment was much larger than 1 in all cases, indicating low risk.

**Chun-Ying Li, He Li, Jae-Keun Choi, Hee-Woong Kim, Soon-Kwan Hong, Zhihao Xu, Hae-Ik Rhee. Physicochemical properties of low-phytate rice cultivar, Sang-gol. J. Korean Soc. Appl. Biol. Chem. 55(1):101-104**

Phytic acid in grains affects the bioavailability of minerals and nutrients in monogastric animals. Physicochemical properties of Sang-gol, a low-phytate rice cultivar developed to decrease anti-nutrient effect of phytic acid, were compared with those of its parent rice cultivar Il-pum. The amylose content of Sang-gol was lower, but its crude protein content was not significantly different compare with Il-pum. Texture profiles of cooked rice, except for hardness, adhesiveness and chewiness, did not show any differences. The hardness, adhesiveness and chewiness of the Sang-gol were lower than that of Il-pum. Pasting characteristics, peak viscosity, trough, and final viscosity of Sanggol were higher, and breakdown was lower, as compared to Il-pum. Setback of Il-pum was significantly (p <0.01) lower than Ilpum. The pasting temperatures of Sang-gol and Il-pum were very similar (68.1 and 68.0°C), respectively.

**Seung Jin Lee, Min Seok Ko, Yung Hun Yang, Sang Mo Kang. Long- and short-term effects of vitamin E administration along with stress on skin tissues of mice. J. Korean Soc. Appl. Biol. Chem. 55(1):105-109**

Vitamin E exists in cellular membranes and has been shown to inhibit consecutive oxidative reactions that occur inside and outside of the cellular membrane. It significantly reduces oxidative stress caused by various factors, and vitamin E radicals can be transformed into vitamin E by interacting with vitamin C and glutathione. Thus, long- and short- term effects of vitamin E on skin tissues caused by stress in young age were examined. Stress decreased the width of the dermal layer, elasticity, and collagen content of the skin and increased the width of the epidermal layer, forming wrinkles. However, administration of vitamin E protected the skin when subjected to stress, resulting in higher skin elasticity, thicker width of the dermal layer and thinner epidermal layer than skin without administration of vitamine E. These results suggest that vitamine E has a positive effect on protecting skin when under stress.

**Choa Hyoung Cho, Tae Woog Jeon, Myung Kon Kim. RETRACTED ARTICLE: Effect of gamma irradiation on color characteristics and biological activities of ethanol extract of Lonicera japonica. J. Korean Soc. Appl. Biol. Chem. 55(1):111-114**

Effects of gamma irradiation on color characteristic and biological activities of ethanol extract of Lonicera japonica irradiated at 0, 10, 20, and 30 kGy were investigated. Hunter color L\*- and a\*-value increased by irradiation in a dose-dependent manner, resulting in lighter color than the nonirradiated, whereas Hunter color b\*-value decreased with increasing irradiation dosage (p <0.05). The L. japonica extract showed inhibition effects against tyrosinase, xanthine oxidase, and nitrite-scavenging ability. Tyrosinase inhibition effect of L. japonica was higher in the gamma-irradiated sample than in the nonirradiated sample, and the effect was increased by increasing irradiation dosages. The L. japonica extracts had a higher inhibitory effect against xanthine oxidase, and the effect was not greatly changed by irradiation. Nitrite-scavenging activity was the highest in L. japonica extract at pH 1.2. Overall, the gamma irradiation may not greatly influence the xanthine oxidase inhibition effect and nitrite-scavenging ability of the L. japonica extract, except for the tyrosinase inhibition effect when irradiated up to 30 kGy.

**JungWoo Park, Min Hee Park, Min Kyu Jeong, Mi-Ja Kim, Ki-Moon Park, JaeHwan Lee. Changes of isoflavone profiles in Cheonggukjang with Lentinus edodes. J. Korean Soc. Appl. Biol. Chem. 55(1):115-119**

Cheonggukjang, a traditional soy food, was prepared with addition of Lentinus edodes powder at 0, 5, and 10% (w/w), and the distribution of isoflavones were analyzed by high performance liquid chromatography during fermentation for 48 h. β-Glucosidase activity and changes in succinyl genistin and succinyl daidzin were monitored. β-Glucosidase activity in cheonggukjang with 5 and 10% (w/w) L. edodes powder were significantly higher than those in control samples (p <0.05). Total isoflavones in 48-h fermented cheonggukjang with 0, 5, and 10% (w/w) L. edodes powder were 4.88, 4.26, and 3.99 μmole/g, respectively. Aglycones of isoflavones in cheonggukjang with 5 and 10% (w/w) L. edodes powder were 27.61 and 24.76% for 24 h and 28.2 and 38.74% for 48 h, whereas those in control samples were 5.50 and 21.11% for 24 and 48 h, respectively. Succinyl daidzin and succinyl genistin in L. edodes powder-added cheonggukjang were significantly lower than those of control samples (p <0.05), implying that β-glucosidase activity from L. edodes negatively affected the formation of succinyl derivatives.

**Dong-Min Kim, Heungsook Lee, Sang-Ho Yoo. Compositional changes and physical properties of soymilk prepared with pre-soaked-fermented soybean. J. Korean Soc. Appl. Biol. Chem. 55(1):121-126**

Effect of lactic acid bacteria-fermented whey in the soybean soaking process of the soymilk production was investigated to minimize bacterial contamination and increase isoflavone and γ-amino butyric acid (GABA) concentrations. Mixed culture of Lactobacillus acidophilus, Bifidobacterium lactis, and Streptococcus thermophilus displayed the highest β-glucosidase activity and was used for the production of health functional soymilk. A significant pH reduction from 6.75 to 5.19 was observed in soymilk product, whereas its titratable acidity increased from 0.18 to 0.24% after 24-h soaking of soybean in fermented whey. Suspension stability of soymilk dramatically dropped between 18- and 24-h soaking periods, largely due to pH reduction, which reflected decrease in solid contents of soymilk from 7.38 to 1.54%. Total isoflavone content significantly decreased with increasing soaking time in the fermented whey, whereas the content of health-beneficial aglycone increased by three fold (0.27 mg/100 mL of soymilk) after 18-h soaking fermentation. The contents of free amino acids (6.0 mg→2.3 mg/100 mL) and GABA (1.1 mg→0.5 mg) in soymilk were reduced in soymilks produced with the fermented soybeans between 18- and 24-h soaking periods. The pH-drop induced solid precipitation, which could exert negative effect on the free amino acid and GABA contents in fermented soymilk.

**Se-Wook Oh, Minseon Koo, Hyun Jung Kim. Contamination patterns and molecular typing of Bacillus cereus in red pepper powder processing. J. Korean Soc. Appl. Biol. Chem. 55(1):127-131**

Prevalence of Bacillus cereus was determined in red pepper powder samples obtained from various processing steps (n=60), swabs of machinery surfaces (n=35), and air samples of the processing room (n=17) during red pepper powder production. The detection rate of B. cereus was high (over 85%) in samples of raw materials and washing steps and decreased to 40% in samples obtained from later stages of processing, i.e. milling, metal detection, and final products. B. cereus was detected in 2.9 and 11.8% of swabs and air samples, respectively. The genetic similarity of B. cereus isolates obtained from various processing steps was compared to identify the sources of contamination for red pepper powder using the repetitive-sequence-based polymerase chain reaction method. For 20 isolates of B. cereus from two independent samplings, 50% of the isolates, which were clustered, consisted of two or more isolates with a similarity greater than 95%. For the isolates obtained from raw materials, crude milling, and milling step of the independent sampling, high genetic similarity (>99.4%) was observed, suggesting that these isolates may have originated from the same clone. The prevalence of B. cereus and molecular typing result suggest possible routes of contamination, such as the transfer of clone contaminated in raw materials to the red pepper powder and cross contamination during processing. Based on this result, more intervention studies to prevent pathogen contamination during red pepper powder processing are needed to insure good hygienic level of products.

**Hyun Chung, Won-Young Chung, Eun-Sook Yoo, Somi Kim Cho, Sea-Kwan Oh, Young-Suk Kim. Characterization of volatile aroma-active compounds in Dangyooja (Citrus grandis Osbeck). J. Korean Soc. Appl. Biol. Chem. 55(1):133-136**

Volatile components in peel and flesh of Dangyooja (Citrus grandis Osbeck) were isolated by solvent-assisted flavor evaporation (SAFE) followed by analysis using gas chromatography-mass spectrophotometry (GC-MS). Twenty-four components, including 4 alcohols, 6 aldehydes, 14 terpene hydrocarbons, and 16 components, including 1 alcohol, 1 aldehyde, 8 terpene hydrocarbons, 4 aromatic compounds, and 2 hydrocarbons were found in peel and flesh of Dangyooja, respectively. Limonene and myrcene were dominant in both parts of Dangyooja, although more volatile components were detected in peel of Dangyooja. Aroma-active compounds in peel and flesh of Dangyooja were also evaluated by aroma extract dilution analysis. Geranial (pineapple-like) showed the highest flavor dilution factor, followed by citronellal (herbaceous) and α-pinene (pine tree-like). In contrast, α-pinene (pine tree-like) and myrcene (floral) were the major aroma-active components in flesh of Dangyooja.

**Jung In Kim, Nam Keun Lee, In-Cheol Yeo, Young Jun Ryu, Hyeon Sook Park, Byung Yong Kim, Hye Kyung Kim, Young Tae Hahm. Isolation of Carotenoid-producing yeast, Rhodosporidium babjevae JI-1, and evaluation of cell extract toxicity against rat hepatic cells. J. Korean Soc. Appl. Biol. Chem. 55(1):137-140**

Carotenoid-producing yeast Rhodosporidium babjevae JI-1 was isolated from citrus fruit peel. The red pigment produced by R. babjevae JI-1 was confirmed as β-carotene. Viability of rat hepatocytes treated with R. babjevae JI-1 cell extract at 20–1,000 μg/mL was about 85.1±15.1–100±14.5%.

**Bong-Gyu Kim, Eung-Ryoung Lee, Joong-Hoon Ahn. Analysis of flavonoid contents and expression of flavonoid biosynthetic genes in Populus euramericana Guinier in response to abiotic stress. J. Korean Soc. Appl. Biol. Chem. 55(1):141-145**

Gene encoding the key flavonoid biosynthetic enzyme, chalcone synthase, in Populus euramericana Guinier (PeCHS) was cloned and characterized. PeCHS preferentially uses feruloyl- CoA as a substrate. Expression of the flavonoid biosynthetic genes, phenylalanine ammonimum lyase from P. euramericana (PePAL), PeCHS, chalcone isomerase from P. euramericana (PeCHI), and, flavonol synthase from P. euramericana (PeFLS) from P. euramericana in response to abiotic stresses such as wounding and UV-irradiation were analyzed. These genes were induced under the stress conditions. Most genes were expressed at an early stage of the stress response. In addition, total flavonoid content increased after UV-irradiation.

**Mei Jing Piao, Hee Kyoung Kang, Eun Sook Yoo, Young Sang Koh, Dong Sam Kim, Nam Ho Lee, Jin Won Hyun. Photo-protective effect of Polysiphonia morrowii Harvey against ultraviolet B radiation-induced keratinocyte damage. J. Korean Soc. Appl. Biol. Chem. 55(2):149-158**

Photo-protective properties of Polysiphonia morrowii ethanol extract (PME) against ultraviolet B (UVB) radiation-induced cellular damage were investigated in human HaCaT keratinocytes. PME exhibited scavenging activity against 1,1-diphenyl-2-picrylhydrazyl radical and intracellular reactive oxygen species induced by either hydrogen peroxide (H2O2) or UVB radiation. In addition, PME scavenged superoxide anion generated by xanthine/xanthine oxidase system and hydroxyl radical generated by the Fenton reaction (FeSO4 + H2O2), both of which were detected using electron spin resonance spectrometry. Moreover, PME, which scavenges H2O2, was shown to contain the antioxidant compound 3-bromo-4,5-dihydroxylbenzaldehyde, possibly accounting for scavenging actions. PME also restored the levels of catalase and superoxide dismutase protein expression and activity that were decreased by UVB radiation. PME reduced UVB-induced apoptosis, as shown by decreased apoptotic bodies and DNA fragmentation. These results indicate that PME protects human keratinocytes against oxidative stress induced by UVB radiation through the enhancement of antioxidant systems.

**Won Sik Choi, Do Yoen Jang, Seok Woo Nam, Byeoung Soo Park, Hoi-Seon Lee, Sung Eun Lee. Antiulcerogenic activity of scoparone on HCl/ethanol-induced gastritis in rats. J. Korean Soc. Appl. Biol. Chem. 55(2):159-163**

Protective effect of ethanol extract from Hericium erinaceus cultivated with Artemisia capillaries (HEAC) on gastric mucosal damage induced by 0.15M HCl in ethanol in rats was evaluated. HEAC showed higher potent protective effect on gastritis with effective dose 50 (ED50) value of 22.6mg/kg compared those of selbex and stillen at 46.5 and 44.2 mg/kg, respectively, the presently used medicines for treating gastritis. ichloromethane fraction showed a dose-dependent protective effect on gastritis with ED50 value of 18.1 mg/kg. The biologically active component of dichloromethane fraction derived from HEAC ethanolic extract was characterized by spectroscopic analysis as scoparone with protective rate of 93% and ED50 value of 4.2 mg/kg on gastritis. Taken together, administration of HEAC and scoparone provided protective effect on the gastric lesion induced by ethanol-HCl and may therefore be a promising drug for treatment of gastritis and gastric ulcer.

**Tae Hoon Kim, Sae-Kwang Ku, Jong-Sup Bae. Effects of (-)-epigallocatechin gallate on HMGB1 and interleukin-1β-mediated barrier disruption in human endothelial cells. J. Korean Soc. Appl. Biol. Chem. 55(2):165-173**

High plasma levels of interleukin (IL)-1β and high mobility group box protein 1 (HMGB1) correlate with poor prognosis and increased mortality in patients with severe inflammation. (-)-Epigallocatechin gallate (EGCG), the main catechin in green tea, has multiple beneficial effects on reduction of inflammatory diseases; however, effects of EGCG on both IL-1β- and HMGB1-mediated barrier disruptive responses of human umbilical vein endothelial cells (HUVECs) have not been examined. Thus, effects of EGCG on IL-1β- and HMGB1-mediated barrier disruption in HUVECs were investigated. EGCG potently inhibited IL-1β or HMGB1-mediated permeability and down-regulated IL-1β and HMGB1-dependent adhesion and migration of THP-1 to activated HUVECs by inhibiting the activation of nuclear factor (NF)-κB and expression of tumor necrosis factor (TNF)-α. EGCG inhibited IL-1β- and HMGB1-mediated expression of cell adhesion molecules. Results showed EGCG has barrier protective activities and may represent a strategy to treat various inflammatory conditions mediated through the inhibition of IL-1β and HMGB1 signaling pathways.

**Jeongmin Song, Hua Zheng, Hyo Jeong Seo, Geun Eog Ji. Effect of oral administration of Scutellaria Baicalensis root extract on atopic dermatitis-like skin lesion induced by oxazolone in hairless mice. J. Korean Soc. Appl. Biol. Chem. 55(2):175-181**

Effect of oral administration of methanolic extract from Scutellaria baicalensis root (SB) on the development of oxazolone-induced atopic dermatitis-like skin lesions in hairless mice was investigated. Mice were orally administered SB 250, 500 mg/kg/day, or dexamethasone 1 mg/kg/day for 33 days. Oral administration of SB inhibited the development of clinical symptoms, and reduced dermal mast cell infiltration, but did not show definite suppressive effect on elevation of serum total IgE level under experimental condition. Interleukin (IL)-6 level in serum and the mRNA expressions of IL-4, IL-13, IL-12, interfereon-γ, transforming growth factor-β, and fork head box P3 in draining lymph nodes were not significantly affected by SB administration, indicating SB could alleviate atopic dermatitis via the inhibition of mast cell infiltration.

**Ha-Yun Song, Hoi-Seon Lee. Antibacterial activity of naphthalin and its derivatives against oral bacteria. J. Korean Soc. Appl. Biol. Chem. 55(2):183-187**

Naphthalin derived from the essential oil of Magnolia liliflora was tested for antibacterial activity against oral bacteria. Naphthalin showed strong growth inhibitory activity against Actinomyces viscosus and Streptococcus salivarius, and exhibited moderate or weak growth inhibitory activity against Porphyromonas spp. and Streptococcus spp. at 2.0 mg/disc, whereas Lactobacillus rhamnosus showed no growth inhibition. Therefore, M. liliflora could be useful as a natural preventive agent.

**Young Soo Keum, Hee Won Park, Hyuk-Hwan Song, Byung-Dong Kim, Byoung-Cheorl Kang, Jeong-Han Kim. Metabolite analysis of long chain branched fatty acids and capsaicin biosynthesis in Capsicum annuum placenta. J. Korean Soc. Appl. Biol. Chem. 55(2):189-195**

Capsaicins, hot principles in Capsicum spp., are produced from vanillylamine and short-chain fatty acids (FAs), originated from branched amino acids. Recently a minor but clear incorporation of longer chain FAs with 14–18 carbons to novel long-chain vanillylamides was reported, which prompted further investigation on possible correlation between metabolism of capsaicins and FA precursors with metabolite profiling. Placenta of Capsicum annuum with different concentrations of capsaicins were extracted and analyzed with gas chromatography-mass spectrometry. Structures of FAs were determined after derivatization to methyl- and picolinyl esters. The results indicate cultivars with more capsaicins contain higher amount of long-chain branched FAs with 14–17 carbons. Some branched FAs showed strong correlation with the level of capsaicins. Most branched FAs are of iso-acids, where the methyl groups are attached at (ω-1) carbon, whereas only one anteiso-FA was observed in a single cultivar. In addition to saturated analogues, several mono-unsaturated branched FAs have also been detected. Location of double bond in these metabolites suggested that short-chain branched FAs may be incorporated in the middle of biosynthesis or at initial steps of long-chain FAs. Accordingly, branched medium- to long-chain FA may be derived mainly from leucine or valine, rather than isoleucine. Results indicate that the short-chain FAs are possible precursors both of capsaicins and methyl-branched longer chain FAs.

**In-Sik Shin, Mee-Young Lee, Chang-Seob Seo, Hye-Sun Lim, Hye-Kyung Ha, Hyeun-Kyoo Shin. Yijin-tang, an oriental herbal formula reduces ethanol-induced acute gastric injury in rats. J. Korean Soc. Appl. Biol. Chem. 55(2):197-204**

Protective effects of Yijin-tang extract (YTE) were investigated on ethanol-induced acute gastric injury. Simultaneous determination of six components, homogentisic aicd, liquiritin, hesperidin, neohesperidin, poncirin, and glycyrrhizin was performed in YTE by high performance liquid chromatography-photodiode. Acute gastric lesion was induced by oral administration of absolute ethanol (5 mL/kg). The positive control (omeprazole, 50 mg/kg) and YTE groups (200 and 400 mg/kg) were administered by oral gavage 2 h prior to ethanol treatment. The animals were sacrificed 1 h after receiving ethanol treatment. Acute toxicity study was performed to evaluate the safety of YTE. YTE protected gastric mucosa against ethanol-induced acute gastric injury including hemorrhage and hyperemia. YTE reduced the elevated lipid peroxidation of stomach and increased the activities of antioxidant enzyme. In the acute toxicity study, YTE did not cause any toxic effect at the dose level of 2000 mg/kg in rats. These results showed that YTE protects gastric mucosa from ethanolinduced acute gastric injury via increasing the antioxidant status. We suggest that YTE has a potential as a therapeutic agent for acute gastric injury.

**In Sik Shin, Mee Young Lee, Hye Sun Lim, Chang Seob Seo, Hye Kyung Ha, Hyeun-Kyoo Shin. Jaeumganghwa-tang, a traditional herbal formula inhibits the development of benign prostatic hyperplasia in rats. J. Korean Soc. Appl. Biol. Chem. 55(2):205-212**

Benign prostate hyperplasia (BPH) is the most common proliferative disorder affecting older men and results in prostate enlargement and lowered urinary tract symptoms. Jaeumganghwa-tang (JGT), an oriental traditional herbal formula, has been used in China (Zi-yin-jiang-huo-tang in Chinese), Japan (Jiin-koka-to in Japanese), and Korea for many years. Effects of JGT on prostate dihydrotestosterone (DHT) level and prostatic hyperplasia were investigated using a rat model, in which BPH was induced using testosterone propionate (TP). Rats were divided into five groups. One group was used as a normal, and four groups received subcutaneous injections of TP for 4 weeks to induce BPH. JGT (200 or 400 mg/kg) was administered daily for 4 weeks by oral gavage concurrently with TP injections, and rats were sacrificed at scheduled times. Prostates were weighed, and histopathologic examination was conducted. DHT levels in serum and the prostate were measured, and the expression of proliferating cell nuclear antigen (PCNA) protein was investigated using Western blotting. BPH animals showed increases in absolute and relative weights of the prostate, levels of DHT in serum and the prostate, and expression of PCNA in the prostate, whereas JGTtreated animals showed significant reductions in these indices compared with the BPH animals. Administration of JGT attenuated TP-induced epithelial hyperplasia. These findings indicate that JGT inhibits the development of BPH, an effect closely associated with a reduction in DHT level.

**Sung-Jun Hong, Ihsan Ullah, Gun-Seok Park, Changhee Lee, Jae-Ho Shin. Overexpression and characterization of recombinant glutamate decarboxylase from Thermococcus kodakaraensis KOD1. J. Korean Soc. Appl. Biol. Chem. 55(2):213-218**

Glutamate decarboxylase (GAD) (EC 4.1.1.15) catalyzes decarboxylation of glutamic acid to produce gammaaminobutyric acid (GABA). A putative gad gene (tk1814) from an archaeon Thermococcus kodakaraensis KOD1 was cloned and transformed into Escherichia coli to produce a bulk amount of recombinant GAD. Activity of the purified GAD was optimal at 90°C and pH 8.0. Optimal concentration of substrate for conversion into gamma-aminobutyric acid by recombinant GAD was 50 mM monosodium glutamate. Recombinant GAD was confirmed to be monomeric, and its activity was greatly inhibited by various salts such as sodium chloride, Tris-HCl, and sodium phosphate. Km, Vmax, and Kcat values were 9.92 mM, 153.8 μmol min−1 mg−1, and 6.613×103 min−1 respectively.

**Zongbao Pan, Hua Tian, Wei Wang, Jun Wang, Shaoguo Ru. Identification, purification, and immunoassay of stone flounder (Kareius bicolouratus) vitellogenin. J. Korean Soc. Appl. Biol. Chem. 55(2):219-227**

Vitellogenin (Vtg), the precursor of egg yolk proteins, serves as nutrients for the developing embryos. Vtg production in male fish has become an excellent biomarker for environmental estrogens. Thus, Vtg synthesis was induced by injection of 17β-estradiol (E2) in stone flounder (Kareius bicolouratus). Plasma from uninduced and E2-treated fish was subjected to native polyacrylamide gel electrophoresis (PAGE) and the gels were stained with Coomassie brilliant blue R250 for proteins, methyl green for phosphates, Sudan black B for lipids, and periodic acid-Schiff’s reagent for carbohydrates. These analyses verified the presence of two phospholipoglycoproteins in the plasma from E2-treated stone flounder, which were tentatively identified as Vtg. Vtg was then isolated by two purification procedures: gel filtration followed by anion exchange chromatography, or selective precipitation combined with anion exchange chromatography. The latter procedure was more effective at isolating Vtg with a high degree of purity. In native PAGE, the apparent molecular masses of Vtgs were determined to be 520 and 550 kDa, respectively. Two major bands with approximate molecular masses of 165 and 106 kDa together with two additional faint bands of lower molecular weights were observed after sodium dodecyl sulfate- PAGE under reducing conditions. These bands exhibited differential affinity for polyclonal antisera against red drum (Sciaenops ocellatus) Vtg in Western blot. The present study established the purification procedure and characterized the electrophoretic and immunological properties of stone flounder Vtg.

**Chang Hee Yang, Byung-Cheol Song, Moonjae Cho. A natural mutation of the hepatitis B virus X gene affects cell cycle progression and apoptosis in Huh7 cells. J. Korean Soc. Appl. Biol. Chem. 55(2):229-236**

Hepatocellular carcinoma (HCC), one of the most prevalent cancers, and HCC-associated diseases are caused by the hepatitis B virus (HBV). Viral sequences often contain mutations in the basal core promoter (BCP), which overlaps with the open reading frame encoding HBV X protein (HBx). HBx protein plays a very important role in the development of HCC. Influence of naturally-occurring mutation of HBx (BCP1) on cell cycle progression was investigated in the Huh7 HCC line. BCP1 mutation was cloned from clinical samples into recombinant green fluorescent protein-fusion expression plasmid constructs that were then transfected into Huh7 cells for either transient expression studies or isolation of stable transfectants, along with wild-type HBx and empty vector controls. The mutant protein was more effective than wild-type in reducing expression of cyclindependent kinase (CDK) inhibitor p27kip1, promoting cell cycle progression, inhibiting production of cleaved poly ADP ribose polymerase (PARP) (a marker for apoptosis), and down-regulating the multifunctional cytokine transforming growth factor-β (TGF-β). Since TGF-controls the cell cycle and apoptosis, the effect of BCP1 mutation on the enhanced activity of HBx to promote cell cycle progression and to inhibit apoptosis in Huh7 cells may result from down-regulation of TGF-β.

**Min Hee Lee, Yu Ran Moon, Hyoung-Woo Bai, Ung-Jin Kim, In-Chul Lee, Tae Hoon Kim, Byung Yeoup Chung. Electron paramagnetic resonance investigation of different plant organs after gamma irradiation. J. Korean Soc. Appl. Biol. Chem. 55(2):237-240**

Total reactive oxygen species (ROS) signals in irradiated Arabidopsis plants were examined by electron paramagnetic resonance (EPR) analysis. At 10 kGy, the EPR signal intensity was highest in the root, whereas relatively low intensity levels were observed in the leaf and stem. The relative unit (r.u.) of control plants was 0.38 in the leaf, which was gradually increased to 0.51, 0.71, and 0.95 r.u. at 1, 5, and 10 kGy, respectively. In the stem, the intensity in all irradiated samples was lowest compared with that in other plant organs such as the leaf and root. The r.u. in the root sharply increased from 0.13 r.u. in control samples to 1.58 r.u. at 10 kGy, with 0.30–0.42 r.u. observed in 1–5 kGy irradiated samples. Stem and leaf extracts showed remarkably high levels of radical scavenging activity at 89.12 and 71.45%, respectively, compared with the very low level of activity in the root at 10.75%. These findings were in good agreement with the extraction yield of each plant organ, which was 20.0, 14.8, and 10.0% in the stem, leaf, and root, respectively. Order of EPR signal intensity and radical scavenging activity was as follows: EPR signal intensity: 1) leaf > root > stem at 1 and 5 kGy, 2) root > leaf > stem at 10 kGy; radical scavenging activity: stem > leaf > root. Results showed high or low levels of EPR signal intensity in different plant organs could be caused by the ROS removal power of extracts from different plant organs.

**Hyeri Lee, Eunhye Kim, Joon-Kwan Moon, Yong-Zhe Zhu, Jung-Ah Do, Jae-Ho Oh, Kisung Kwon, Young Deuk Lee, Jeong-Han Kim. Establishment of analytical method for cyazofamid residue in apple, mandarin, korean cabbage, green pepper, potato and soybean. J. Korean Soc. Appl. Biol. Chem. 55(2):241-247**

A precise single residue analytical method was developed for fungicide cyazofamid in various crops. Apple, mandarin, Korean cabbage, green pepper, potato, and soybean were selected as representative crops, and clean-up system, partition solvent and extraction solvent were optimized. Limit of quantitation (LOQ) of cyazofamid was 2 ng (S/N>10) and good reproducibility was observed with small coefficient of variation (<4%). Excellent linearity was achieved between 0.05 and 20 mg/kg of cyazofamid standard solutions, with coefficients of determination of 1.000. Method limit of quantitation (MLOQ) was 0.02 mg/kg. For recoveries tests, crop samples were macerated and fortified with cyazofamid standard solution at three fortification levels (MLOQ, 10 MLOQ, and 100 MLOQ). And then those were extracted with acetone, concentrated and partitioned with dichloromethane. Then the extracts were concentrated again and cleaned-up through Florisil® column with ethyl acetate: n-hexane (30:70, v/v) before concentration and analysis with HPLC. Good recoveries from 75.3 to 98.5% with coefficients of variation of less than 10% were obtained, regardless of sample type, which satisfies the criteria of KFDA. Those results were reconfirmed with LC-MS/MS. The method established in this study could be applied to most of crops as an official and general method for residue analysis of cyazofamid.

**Hee-jin Jun, Qingcheng Wen, Ji Hae Lee, Jungae Jeun, Hwa-Jung Lee, Kwang-Geun Lee, Sea-Kwan Oh, Sung-Joon Lee. Effects of Korean black raspberry wines on hepatic cholesterol metabolism and retinal vascular formation in vitro. J. Korean Soc. Appl. Biol. Chem. 55(2):249-257**

Toxicity, antioxidant activity, and biological functionality of Korean black raspberry wine (KBRW) extracts on human ARPE-19 and HepG2 cells were determined using MTT and lipid/malonaldehyde (MA) assays and reverse transcription polymerase chain reaction (RT-PCR) as well as anti-obesity effect of KBRW extracts on various cancer cells. All samples inhibited MA formation by 38.0–88.0%. Bokbunja and Sanmaesu exerted greater inhibitory effect than other wines. Both cell lines were each treated with KBRW for 24 h, and viability was measured by MTT assay. No toxicity was found, even at 500 μg/mL. Changes in gene expression for CYP7A1, low-density-lipoprotein receptor (LDL) receptor, 3-hydrozy-3-methylglutaryl-CoA (HMG-CoA) reductase, and vescular endothelial growth factor (VEGF) were assessed by semiquantitative RT-PCR. CYP7A1 and LDL receptor expressions in ARPE-19 cells were elevated, whereas HMG CoA reductase expression was decreased by Bokbunja and Sanmaesu. Expression of VEGF was decreased by Bokbunja but elevated by Sanmaesu. In HepG2 cells, gene expression was similar after Bokbunja and Sanmaesu treatments. CYP7A1 and HMG CoA expressions were elevated. LDL receptor expression was increased by Bokbunja but decreased by Sanmaesu. Bokbunja and Sanmaesu inhibited VEGF expression but elevated those of CYP7A1 and HMG CoA reductase. Bokbunja and Sanmaesu displayed anti-cholesterol effects that could be attributed to increased gene expression in CYP7A1 and HMG CoA reductase.

**Yoon-Hee Chung, Ji-Won Song, Kwon-Young Choi, Jang Won Yoon, Kyung-Mi Yang, Jin-Byung Park. Cloning, expression, and characterization of P450 monooxygenase CYP102H1 from Nocardia farcinica. J. Korean Soc. Appl. Biol. Chem. 55(2):259-264**

To isolate a new P450 monooxygenase belonging to the CYP102 family, CYP102H1 of Nocardia farcinica IFM 10152 (i.e., pnf11580) was cloned, expressed, and partially characterized. CYP102H1 gene was amplified from pNF1 of N. farcinica and cloned into expression vectors (i.e., pTrc99A, pET28a(+)). When Escherichia coli BL21(DE3) codon+ strain was transformed with pET28a-CYP102H1 and the culture was induced with 1.0 mM isopropyl-β-d-thio-galactoside in a complex medium at 30°C, CYP102H1 could be expressed in soluble form even though soluble form was not dominant. The enzyme showed typical features of heme proteins; a spectrum of reduced CO bound form showed typical maximum at 450 nm. When the biotransformation of linoleic acid was carried out in a reconstituted system consisting of CYP102H1 and redox partner proteins of Pseudomonas putida (i.e., CamAB), ω1-hydroxylinoleic acid was detected with gas chromatography/mass spectrometry analysis, suggesting that CYP102H1 catalyzes oxygenation of linoleic acid at ω-1 position, which is typical in CYP102A subfamily members.

**Hye-Yun Park, Bo-Youn Jang, Yong-Il Hwang, Sun-Uk Choi. Construction of intergeneric conjugal transfer for molecular genetic studies of Streptomyces acidiscabies producing thaxtomin. J. Korean Soc. Appl. Biol. Chem. 55(2):265-269**

Effective transformation procedure to facilitate molecular genetic studies of Streptomyces acidiscabies producing thaxtomin, which causes scab diseases in the economically important root and tuber crops was established via transconjugation from Escherichia coli ET12567 using an ØC31-derived integration vector, pSET152, harboring the oriT and attP fragments. Greatest number of exconjugants was achieved on MS medium containing 50 mM MgCl2 without heat treatment of spores and E. coli cells. Additionally, the integration site, attB, of the genome of S. acidiscabies exhibited the highest degree of homology with S. avermitilis and its chromosomal location was found to exist as a single attB site within an open reading frame coding for a pirin homolog similar to those identified in other actinomycetes.

**Su Hwan Kim, Young Jin Choi, Hanna Lee, Sang-Hwa Lee, Jun-Bae Ahn, Bong-Soo Noh, Sea Cheol Min. Physicochemical properties of jujube powder from Air, vacuum, and freeze drying and their correlations. J. Korean Soc. Appl. Biol. Chem. 55(2):271-279**

Physical and chemical properties of jujube powder with different powder sizes prepared by different drying methods were determined, and correlations of the properties were statistically analyzed. Air-, vacuum-, and freeze-dried (AD, VD, and FD, respectively) jujube were milled and sieved to produce powders. Powder size, morphological characteristics, color, volatile profile, moisture sorption isotherm, water solubility, rehydration, total sugar content, and polyphenol content of the powder were determined. Hunter L, a, and b, degree of browning, and volatile profile varied depending on drying methods. Moisture sorption isotherms exhibited typical Type II sigmoidal shape. Polyphenol content was highest in AD powder (2.6±0.1 mg/g). Powder size, morphology, water solubility, and total sugar content were not different by different drying methods. Correlations identified among the properties indicate rehydration of the powder could be maximized by controlling particle size and water activity of the powder. Rehydration and powder size of AD, VD, and FD powder were significantly correlated (p <0.001) (R 2= 0.92, 0.88, and 0.94, respectively). Property correlations determined could be useful in customizing properties of jujube powder and increasing commercial uses of the powder.

**Ji Young Yang, Soon Young Jang, Hyun-Ku Kim, Seon Joo Park. Development of a molecular marker to discriminate Korean Rubus species medicinal plants based on the nuclear ribosomal DNA internal transcribed spacer and chloroplast trnL-F intergenic region sequences. J. Korean Soc. Appl. Biol. Chem. 55(2):281-289**

Rubi Fructus (Bokbunja in Korean) is a traditional oriental medicine often prescribed as the immature fruit of Rubus coreanus in the Korean pharmacopoeia or Rubus chingii in the Chinese pharmacopoeia. However, Rubus crataegifolius is presently the most popular form in the market. Correctly identifying these fruits is difficult due to morphological similarities in their dried immature forms. Therefore, nucleotide sequences of nuclear ribosomal DNA (nrDNA), internal transcribed spacer, chloroplast DNA (cpDNA) trnL-F, and psbA-trnH intergenic spacer were analyzed to develop objective methods for discrimination among R. coreanus, R. crataegifolius, and R. chingii. Based on trnL-F intergenic sequences, three sequence characterized amplified region (SCAR) markers (CorF/CorR, HwaF2/HwaR2, SanF/SanR) were developed to distinguish the three species. Furthermore, phylogenetic analysis of the trnL-F intergenic sequences showed that R. crataegifolius is widely distributed in the Korean Rubi Fructus market as Korean product and imported goods from China. Single nucleotide polymorphism (SNP) that can be used to discriminate Korean Bokbunja medicine from those imported from China was developed, established the SNP marker, and conducted real-time PCR with a designed inflorescence probe. The developed SCAR marker and SNP probe were useful for distinguishing and authenticating the Korean and Chinese species that constitute Rubi Fructus medicines.

**Mi-Ra Yoon, Sang-Chul Lee, Mi-Young Kang. The lipid composition of rice cultivars with different eating qualities. J. Korean Soc. Appl. Biol. Chem. 55(2):291-295**

Lipid composition of three rice varieties (Koshihikari, Dongjin, and Singeumo) with varying palatability was investigated. Results from both Toyo taste and sensory analyses indicated that Koshihikari, Dongjin, and Singeumo have high, medium, and low eating qualities, respectively. Koshihikari was also found to have better texture properties and higher Mg/K ratio, indicating a better eating quality. Major fatty acids found in both starch and nonstarch lipids of rice were linoleic, oleic, and palmitic acids. Dongjin contained the highest non-starch lipid content, but also had the lowest starch lipid level. Oleic acid concentrations were higher in both the high-palatable Koshihikari and low-palatable Singeumo than in Dongjin, whereas Dongjin showed high levels of palmitic and linoleic acids. Squalene, campesterol, and cycloartenol contents were substantially higher in Koshihikari than in the rice varieties with lower palatability. These findings demonstrate that rice concentrations of plant sterols, particularly cycloartenol and squalene, appear to have a positive effect on its palatability.

**Soon-Mi Shim. Comparison of volatile and non-volatile compounds as antioxidant indicators of water spinach (Ipomoea aquatic Forsk.). J. Korean Soc. Appl. Biol. Chem. 55(2):297-302**

Profiling of volatile and non-volatile compounds in stems and leaves of water spinach was performed using gas chromatography-flame ionization detector (GC-FID) and GC/ mass spectrometry (MS) method after derivatization. Antioxidant activity was measured by both 1-diphenyl-2-picrylhydrazyl (DPPH) assay and Folin-Ciocalteu total phenol assay. Partial least squares regression (PLSR) was performed to determine the most important volatile and non-volatile compounds with antioxidant activity in both stem and leaf of water spinach. Phytosterol (26.97 and 19.78%), terpene (5.71 and 7.73%), phenolic compounds (3.87 and 2.66%) and Vit E (2.52 and 2.26%) were found to be major volatile compounds in both stem and leaf of water spinach, respectvely. Among the non-volatile compounds, significant amounts of amino acids (31.48 and 18.83%), sugar and sugar alcohol (32.17 and 18.58%), and fatty acids (7.07 and 26.39%) were found in stem and leaf of water spinach, respectively. DPPH free radical-scavenging effect in stem (92.11%) was higher than that in leaf (84.03%), whereas, electron-reducing capacity was higher in leaf (287.45 μg GAE/mL) than in stem (216.45 μg GAE/mL). Results show that water spinach exerts antioxidant activity via volatile compounds (phytosterol) in stems and nonvolatile compounds (amino acids, acids, sugar alcohols) in leaves.

**Hui Teng, Yong Hee Choi. Optimization of extraction of total alkaloid content from rhizome coptidis (Coptis chinensis Franch) using response surface methodology. J. Korean Soc. Appl. Biol. Chem. 55(2):303-309**

Alkaloids, a group of second metabolites from plants, possess great health benefits against various chronic diseases. Rhizome coptidis (Coptis chinensis Franch) is a commonly used traditional Chinese herb that contains abundant alkaloids but rarely used. In the present study, the effects of process variables on alkaloid content from rhizome coptidis were investigated, and extraction temperature above 80°C was found to have insignificant effect. To achieve maximal extraction of alkaloids from rhizome coptidis, a five-level, three-variable small composite design was employed, and optimal conditions of extraction time, ethanol concentration, and solvent to sample ratio were obtained using response surface methodology. Based on the analysis of variance results, extraction time, and solvent to sample ratio were identified as critical variables in extraction process, and the optimum extraction conditions were an extraction time of 133 min, ethanol concentration of 45%, and solvent to sample ratio of 42 v/w, and under these conditions, the experimental total alkaloid content was 15.96±0.15 g BCE/100 g, which well matched with the predicted value.

**Soon-Mi Shim. Chelating effect of leek (Allium tuberosum Rottler ex Sprengel) containing chlorophyll on Cd, Pb, and As. J. Korean Soc. Appl. Biol. Chem. 55(2):311-315**

Effect of leek (Chinese chive) on bioaccessibility of arsenic (As), cadmium (Cd), and lead (Pb) was determined in comparison with sodium copper chlorophyllin (SCC) using in vitro digestion model. Leek (0, 6, 12, 60, and 120 mg) and SCC (0, 1, 5, 10, and 50 mg) were digested with equal concentration (10 ppm) of As, Cd, and Pb. Concentration of each heavy metal in aqueous phase following in vitro digestion was measured using an inductively coupled plasma optical emission spectrometer. Changes in absorbance spectra of chlorophyll extracted from leek and SCC by heavy metals were measured at 0, 1, 2, and 3 h after mixing. Results showed that the concentration of each heavy metal in aqueous phase decreased with increasing amounts of leek and SCC. At the highest level of leek (120 mg), the concentrations of As, Cd, and Pb decreased to 93.9, 87.1, and 58.2%, respectively. Absorbance of chlorophyll drastically decreased after 1 h of mixing with each As, Cd, and Pb, and no difference in the absorbance was observed after 2 and 3 h. This result indicates that mixing chlorophyll extracted from leek with each heavy metal for 1 h was sufficient for chelating As, Cd, and Pb ions. On the other hand, SCC and each heavy metal showed a decreasing pattern of absorbance without any significant difference for 3 h, indicating that chlorophyll from leek was more effective than SCC, a commercial grade chlorophyll derivative, in chelating As, Cd, and Pb. Results showed leek reduces heavy metals in humans.

**Hee Ju Lee, Cheol-Ho Pan, Eun-Sil Kim, Chul Young Kim. Online high performance liquid chromatography (HPLC)-ABTS+ based assay and HPLC-electrospray ionization mass spectrometry analysis of antioxidant phenolic compounds in Salsola komarovii. J. Korean Soc. Appl. Biol. Chem. 55(2):317-321**

Online high performance liquid chromatography (HPLC)-2,2′-azinobis(3-ethylbenzothiazoline-6-sulfonic acid) radical cation (ABTS+) based assay system for phenolic antioxidants in Salsola komarovii extracts was applied. HPLC elute was mixed with a stabilized solution of ABTS+ reagents, and the negative peaks, indicating the antioxidant activity, were monitored by measuring the decrease in absorbance at 734 nm. HPLC with electrospray ionization mass spectrometry was used to identify the seven flavonoids and two phenolic amides in the S. komarovii extracts. The antioxidant compounds were identified as rutin, isoquercitrin, astragalin, and isorhamnetin.

**Hye Lin Park, Man-Ho Cho, Dong Ho Shin, Seong Hee Bhoo, Tae-Ryong Hahn. Molecular characterization of phytochromeinteracting nascent polypeptide associated complex protein in Arabidopsis thaliana. J. Korean Soc. Appl. Biol. Chem. 55(2):323-326**

Nascent polypeptide associated complex (NAC) proteins bind to newly synthesized polypeptide chains from ribosome and are involved in various physiological processes. An in vitro pulldown assay demonstrated that the previously identified NAC protein interacts with phytochromes. Phytochrome-interacting NAC protein (PNAC) was expressed in the cytosol, and translocation of the PNAC protein into nucleus by irradiation was not observed. These findings suggest that PNAC is a possible cytosolic partner protein to phytochromes. Histochemical analysis of PNAC promoter-β-glucuronidase (GUS) transgenic plants showed that PNAC expression was increased by light treatment, especially red light, indicating that phytochromes likely modulate PNAC gene expression.

**Ji-Ho Lee, Eun-Jung Jeong, Geon-Jae Im, Won-Il Kim. Effects of mining-impacted polished rice on the glutathione peroxide and glutathione S-transferase activities, and oxidative stress-induced apoptosis signal regulating Kinase 1, p38 mitogen-activated protein kinase isomer, and jun N-terminal kinase in human keratinocytes cell. J. Korean Soc. Appl. Biol. Chem. 55(2):327-332**

In toxic elements (TEs)-contaminated polished rice, human keratinocytes cell viability was significantly inhibited to a maximum of 30%. Glutathione peroxide (GPx) and glutathione Stransferase (GST) activities, and gene activation of apoptosis signal regulating kinase 1 (ASK1) were significantly induced at 72 h. Strong activation in p38α-, weak activation in p38δ-, and no expression in p38 β,γ-mitogen-activated protein kinase (MAPK), and jun N-terminal kinase (JNK) were observed at 24 and 72 h. At protein level, the ASK1 and p38 MAPK activities were found to be strongly stimulated at 72 h, whereas phosphorylated ASK1 and p38 MAPK proteins were not detected in contaminated polished rice. Both JNK and phosphorylated JNK were not activated at 24 and 72 h. These results demonstrate that mine-impacted polished rice induced HaCaT cell toxicity associated with oxidative stress.

**Jin Mi Chun, Kyoung Jin Nho, A. Yeong Lee, Byeong Cheol Moon, Jun Yeon Park, Ho Kyoung Kim. A methanol fraction from Chaenomeles sinensis inhibits hepatocellular carcinoma growth in vitro and in vivo. J. Korean Soc. Appl. Biol. Chem. 55(3):335-341**

The fruits of Chaenomeles sinensis have numerous therapeutic properties, including anticancer and antiinflammatory activities; however, its antitumor activity and underlying molecular mechanism are poorly understood. The present study evaluated the in vitro and in vivo antitumor activities of a fraction of C. sinensis extract purified on amberlite resin and eluted in 30% methanol (CSAM 30). In vitro, cell viability was assessed using the CCK-8 assay, cell cycle was analyzed by flow cytometry, and apoptosis was measured by Hoechst DNA staining, caspase activity assays and Western blotting. In vivo antitumor efficacy of CSAM 30 was evaluated by oral administration on the human HepG2 hepatocellular carcinoma preclinical xenograft model. In vitro, CSAM 30 inhibited HepG2 cell proliferation and induced apoptosis via activation of caspases, cleavage of poly ADP-ribose polymerase, up-regulation of Bad, and down-regulation of Xlinked inhibitor of apoptosis protein XIAP and bcl-2. In vivo, CSAM 30 inhibited HepG2 tumor growth in a dose-dependent manner without inducing body weight loss. These results demonstrate that CSAM 30 induces apoptosis and has antitumor activity in vivo and in vitro.

**Seong-Soo Choi, Soo-Hyun Park, Yun-Beom Sim, Hong-Won Suh. Effect of decursinol on the aspirin-induced gastric ulcer in mice. J. Korean Soc. Appl. Biol. Chem. 55(3):343-345**

Decursinol is one of the coumarins purified from the dried roots of Angelica gigas Nakai (Umbelliferae) and has various pharmacological effects including an analgesic property. Although aspirin is widely used to reduce pain and inflammation, aspirin-induced gastric damage remains the major limitation to its use. Therefore, the anti-ulcer activity of decursinol in aspirininduced gastric ulcer in mice was examined. One group of mice was treated orally once daily with aspirin (300 mg/kg) and another group was co-administered with decursinol (10, 25, 50, and 100 mg/kg) and aspirin (300 mg/kg) orally once daily for 5 consecutive days. On day 6, the gastric mucosae were examined. Animal groups co-administered with decursinol and aspirin exhibited a dose-dependent reduction of gastric damage against aspirin-induced gastric ulceration. The extent of inhibitions for the respective doses employed was 11.1, 15.8, 50.3, and 70.4%, respectively. These results suggest that combination therapy with aspirin and decursinol may be useful to alleviate pain and inflammation without major gastrointestinal side effects.

**Ki Cheon Kim, Kyoung Ah Kang, Chae Moon Lim, Jun Ho Park, Kwang Sun Jung, Jin Won Hyun. Water extract of edible bird’s nest attenuated the oxidative stress-induced matrix metalloproteinase-1 by regulating the mitogen-activated protein kinase and activator protein-1 pathway in human keratinocytes. J. Korean Soc. Appl. Biol. Chem. 55(3):347-354**

To better understand the molecular mechanisms underlying the anti-aging properties of water extract of edible bird’s nest (WEBN), the effect of WEBN on oxidative stress-induced matrix metalloproteinase-1 (MMP-1) was assessed in human HaCaT keratinocyte. Upon exposure to H2O2, WEBN inhibited H2O2-induced cytotoxicity and scavenged intracellular reactive oxygen species, down-regulated H2O2-induced MMP-1 mRNA expression, protein expression and activity, and lowered the activation of extracellular signal-regulated protein kinase (ERK) and c-Jun N-terminal kinases (JNK), which are the upstream of MMP-1 expression. Furthermore, WEBN inhibited the expression of c-Fos and phospho c-Jun, which are components of the transcription factor activator protein-1 (AP-1), AP-1 transcriptional activity, and AP-1 binding to the MMP-1 promoter. These data indicate that the anti-aging properties of WEBN involve the inhibition of MMP-1 expression via down-regulation of the ERK /JNK and AP-1 pathway.

**Hyun Young Kim, Ki Ho Lee, Dong Gu Lee, Sanghyun Lee. The protective activity of linear furanocoumarins from Angelica dahurica against glucose-mediated protein damage. J. Korean Soc. Appl. Biol. Chem. 55(3):355-358**

Advanced glycation end products (AGEs) are known to be directly involved in diabetes mellitus and aging. Therefore, protective activities of isoimperatorin, imperatorin, byakangelicin, and oxypeucedanin hydrate from Angelica dahurica on the formation of AGEs were examined using an in vitro glycation reaction. Isoimperatorin showed strong inhibitory activity against the formation of AGEs. The inhibitory activity of isoimperatorin was more potent than that of the positive control, aminoguanidine. These results suggest that isoimperatorin from A. dahurica may be a promising agent for the treatment of glycation-associated diseases.

**Zhehao Jin, Jin-Hee Kim, Kwan-Su Kim, Sang Un Park, Soo-Un Kim. Increased indigoid accumulation by plant defense activators in Polygonum tinctorium Lour. J. Korean Soc. Appl. Biol. Chem. 55(3):359-362**

Effect of plant defense activator on Polygonum tinctorium was evaluated to increase indigoid content in P. tinctorium. Three plant defense activators, 2,1,3-benzothiadiazole (BTH), 2,6-dichloroisonicotinic acid (INA), and acibenzolar-S methyl (ASM) were treated to two cultivars (Naju Local and Naram Blue) under the field condition at two different concentration regimens of 0.3 and 3 mM and harvested 7 days after treatment. The treatments increased indigo accumulation by 40 to 109% with statistical significance. Considering the treatment concentrations, BTH and INA at 0.3 mM were judged to be optimal with 2-fold increase in indigoid concentration. No statistical differences were found in the cultivars and maturity of leaves in the indigoid accumulation caused by plant activator treatment. This result is directly applicable to the P. tinctorium cultivation with high economic significance.

**Seung-Hyun Son, Min-Kyun Kim, Seong-Ki Kim. Biotransformation of 6-deoxo type brassinosteroids in yeast (Saccharomyces cerevisiae) WAT21 cells. J. Korean Soc. Appl. Biol. Chem. 55(3):363-366**

We recently demonstrated that non-plant cells, yeast WAT21, produce a steroidal plant hormone, castasterone. To understand how castasterone is generated in WAT21 cells, deuteriumlabeled (26, 28-2H6) 6-deoxoteasterone, 6-deoxotyphasterol and 6-deoxocastasterone were fed to WAT21 cells, and their metabolites were analyzed by gas chromatography-mass spectrometry. When [2H6]-6-deoxoteasterone was fed, [2H6]-6-deoxo-3-dehydroteasterone and [2H6]-6-deoxotyphasterol were identified as metabolites. When [2H6]-6-deoxotyphasterol was used, [2H6]-6-deoxoteasterone and [2H6]-6-deoxo-3-dehydroteasterone and [2H6]-6-deoxocastasterone were detected. When [2H6]-6-deoxocastasterone was added, [2H6]-castasterone was identified. Taken together, a biosynthetic sequence, 6-deoxoteasterone↔6-deoxo-3-dehydroteasterone↔6-deoxotyphasterol→6-deoxocastasterone→castasterone seems to function to produce brassinosteroids in WAT21 cells. Coupled with the presence of a biosynthetic sequence, teasterone→3-dehydroteasterone↔typhasterol →castasterone, this suggests that brassinosteroids in WAT21 cells were biosynthesized via the same kind of pathways established in plants. This study provides a clue for possible mass-production of brassinosteroids in non-plant cells, yeast WAT21 for commercial use in agriculture.

**Kong-Sik Shin, Myung-Ho Lim, Hee-Jong Woo, Sun-Hyung Lim, Hong-Il Ahn, Jin-Hyoung Lee, Hyun-Suk Cho, Soon-Jong Kweon, Seok-Cheol Suh. Event-specific qualitative and quantitative polymerase chain reaction methods for detection of insect-resistant genetically modified Chinese cabbage based on the 3′-junction of the insertion site. J. Korean Soc. Appl. Biol. Chem. 55(3):367-375**

Transgenic Chinese cabbage 416-3 was developed in Korea by a transformation event involving modified insectresistant gene (cry1Ac1). To monitor unintended release of genetically modified (GM) Chinese cabbage in the future, as well as to meet GM-labeling requirements, the development of a reliable method for detection of GM cabbage is requisite. To develop qualitative and quantitative polymerase chain reaction methods for the insect-resistant GM Chinese cabbage, a cytosolic glutathione reductase (BcgGR1) gene was used as the endogenous reference gene. Primer pairs CGR-1/-2, amplifying the Chinese cabbage endogenous gene, yielded an expected amplicon of 121 bp, whereas no amplified product was observed when DNA samples from seven non-cabbage plants were used as templates. The event-specific primer pairs amplifying the junction site between the endogenous genome sequence and the transferred DNA of GM event 416-3, produced amplicons of desired size by qualitative polymerase chain reaction (PCR) assay. An eventspecific quantitative PCR detection method was established using a TaqMan probe and a standard plasmid as a reference molecule, which contained both endogenous and event-specific sequences. For the validation of this method, three different compositions of w/w mixed samples (containing transgenic DNA at 5, 1, and 0.5% of total DNA in the control samples) were quantified. The precision, expressed as standard deviation (SD) and relative standard deviations (RSD), deviated by 0.03–0.26% and 4.75–8.06%, respectively. These results clearly demonstrate that the PCR methods developed herein can be used for event-specific qualitative and quantitative testings of insect-resistant GM Chinese cabbage.

**Yunyoung Kwak, Jang-Eok Kim, In-Jung Lee, Jong-Guk Kim, In-Koo Rhee, Jae-Ho Shin. Biodegradation of tolclofos-methyl by extracellular secreted organophosphorus hydrolase in recombinant Escherichia coli. J. Korean Soc. Appl. Biol. Chem. 55(3):377-384**

Fungicide tolclofos-methyl [(O,O-dimethyl O-(2,6-dichloro-4-methylphenyl) phosphorothioate)], belonging to the group of organophosphorus compounds, has been usually applied for the effective control of soil born diseases by Rhizoctonia solani. However, its excessive usages have leaded to the accumulation of this compound on soil and ginseng itself. Therefore, we practiced the actual degradation of tolclofos-methyl using organophosphorus hydrolase (OPH). A gene encoding OPH from Flavobacterium sp. strain ATCC 27551 was cloned and expressed in Escherichia coli with or without signal peptide-encoding sequences under control of a T7 promoter. High-level expression of recombinant OPH was verified by specific OPH activity assay. In addition, although the extracellular secretion of OPH in E. coli has never been reported till now, secretion of the recombinant OPH was observed when a signal peptide of the gene was truncated. Recombinant E. coli strain removed a maximum of 80% of the organophosphorus compound tolclofos-methyl, as determined by an in vitro assay. The present study reports for the first time on the secretion of recombinant OPH not affected by signal peptide sequence in E. coli and biodegradation of tolclofos-methyl by extracellular secreted OPH from recombinant E. coli.

**Byung Yeoup Chung, Jae Taek Lee, Seung Sik Lee, Ung-Jin Kim, Seung Gon Wi, Hyoung-Woo Bai, Jae-Young Cho. A comparison of the efficiency of electron beam irradiation on enzymatic hydrolysis between 4 doses of 25 kGy and a single dose of 100 kGy for bioethanol production. J. Korean Soc. Appl. Biol. Chem. 55(3):385-389**

A significant challenge in biofuel production is the inefficient hydrolysis of lignocellulosic materials into simple sugar for conversion into fuel ethanol. This low efficiency results in part from lignin restricting the access of degradative enzymes to cellulose. Wheat straws exposed to electron beams ranging from 0 to 100 kGy were examined to determine effect of divided irradiation (25 kGy in 4 tandem doses) vs. single irradiation (100 kGy). Yields of reducing sugars such as glucose and xylose after divided irradiation (51.1%) showed only a small increase relative to the control (40.9%), whereas in single irradiation, the yields of reducing sugars substantially increased to 74.9%. Results of X-ray diffraction showed crystallinity of cellulose slightly decreased from 43.0 to 38.8% after divided irradiation. Significant decrease to 34.1% was observed after single irradiation. Removal of hemicelluloses and modification of lignin polymer were also observed. These results indicate electron beam irradiation has destructive influence on both physical and chemical properties of wheat straw, thereby increasing accessibility of the cellulose surface to enzymatic hydrolysis and theoretically enable more efficient cellulose hydrolysis. Moreover, divided irradiation did not show a significant influence on enzymatic hydrolysis; hence, the single irradiation process is more effective than divided irradiation for increasing hydrolysis efficiency.

**Jong-Su Seo, Joon-Kwan Moon, Jeong-Han Kim. Photodegradation of pyribenzoxim in water. J. Korean Soc. Appl. Biol. Chem. 55(3):391-396**

Photolysis of pyribenzoxim was assessed in various aqueous solutions under sunlight. In direct photolysis, half-lives of pyribenzoxim were 26.9 and 9.2 days for deaerated and nondeaerated distilled water, respectively. Five photoproducts, bispyribac, benzophenone oxime, 2-hydroxy-6-(4,6-dimethoxypyrimidin-2-yloxy)benzoic acid, benzophenone, and 2-hydroxy-6-(4-hydroxy-6-methoxy-pyrimidin-2-yloxy)benzoic acid, were identified after irradiation under a xenon lamp for 4 h. In indirect photolysis, halflives of pyribenzoxim were 6.0, 3.6, 4.8, 2.2, 11.4, and 9.8 days for humic water, paddy water, rose bengal, Fenton’s reagent, furfuryl alcohol, and mixture of furfuryl alcohol and rose bengal. The photolysis rate of pyribenzoxim in Fenton’s reagent aqueous solution was faster than other sensitizers. Furfuryl alcohol, a singlet oxygen quencher, inhibited the photodegradation of pyribenzoxim to some extent.

**Md. Ramjan Ali, Moon Jeong Yong, Rajendra Gyawali, Ashik Mosaddik, Youn Chul Ryu, Somi Kim Cho. Mango (Mangifera indica L.) peel extracts inhibit proliferation of HeLa human cervical carcinoma cell via induction of apoptosis. J. Korean Soc. Appl. Biol. Chem. 55(3):397-405**

Flesh and peel extracts of five mango varieties were compared for their antioxidant and antiproliferative activities. Fozli peel (FP) extract was found to have the highest antioxidant activity and to significantly inhibit the proliferation of HeLa human cervical carcinoma cells in a dose-dependent manner. Hoechst 33342 staining revealed apoptotic nuclei with condensed chromatin, and cell growth arrest was confirmed by flow cytometry. Apoptotic signaling induced by FP extract was characterized by an increased Bax/Bcl-2 ratio and down-regulation of Bcl-2. Moreover, FP extract treatment triggered the proteolytic activation of caspases-3, -8, and -9 and the degradation of poly ADP-ribose polymerase in HeLa cells. These results indicate that FP is an excellent source of phenolic and/or flavonoid compounds, and may have applications in the treatment of human cervical carcinoma and as an antioxidant in the food and pharmaceutical industries. Gas chromatography-mass spectrometry analysis of FP extract revealed that 2,5-dihydroxyphenol was detected with highest amount and other compounds such as 5-hydroxymethyl-2-furancarboxaldehyde, pentadecanoic acid, (Z,Z)-9,12-octadecadienoic acid, and 2,3-dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one were also found in high amounts.

**Ji-Hyun Lee, Jae-Jun Ahn, Kashif Akram, Gui-Ran Kim, Joong-Ho Kwon. Comparison of electron spin resonance (ESR) spectra of irradiated standard materials using different ESR spectrometers. J. Korean Soc. Appl. Biol. Chem. 55(3):407-411**

Identification of different irradiated foods containing cellulose, sugars, or bone is possible using electron spin resonance (ESR) spectroscopy. In the present study, ESR spectral characteristics of radiation-induced radicals in irradiated standard materials (cellulose, sugars, and hydroxyapatite) were compared using different ESR spectrometers, such as JES-300 (JEOL, Japan), Miniscope MS-400 (Magnettech, Germany), and e-scan™ Food analyzer (Bruker, USA). Upon irradiation (0–10 kGy), all standard materials showed typical radiation-specific ESR spectra. Instrumental variations in signal intensity, spectral shapes, and detection applicability were observed and should be taken into consideration from practical point of view.

**Yujeong Kim, Sang-Ho Yoo, Kwan-Hwa Park, Jae-Hoon Shim, Suyong Lee. Functional characterization of native starches through thermal and rheological analysis. J. Korean Soc. Appl. Biol. Chem. 55(3):413-416**

Native starch samples (corn, rice, and tapioca starches) were prepared in an aqueous slurry and dough system, and their functional properties were evaluated in terms of thermal and rheological characteristics. The pasting property results of starch slurries showed that rice starch exhibited the lowest peak temperature, whereas the highest peak viscosity was observed in tapioca starch. When starch suspensions were subjected to dynamic oscillatory temperature sweep testing, the increased storage moduli and reduced tan δ derived from starch gelatinization were clearly observed in all starch samples, showing that the gelatinized starch granules became more elastic. Steady shear measurements revealed the shear-thinning behaviors of starch pastes, which were dominant in tapioca starch, compared to the other starches. In addition, the distinct endothermic peaks of starch gelatinization were observed at 73.15, 62.25, and 70.55°C for corn, rice, and tapioca starches, respectively and these trends were in good agreement with the pasting and viscoelastic results. However, upon incorporation of the native starches to a wheat dough system, the highest dough consistency during heating and cooling was observed in corn starch probably due to the rigidity of its particle. Thus, the physicochemical response of native starches to temperature appeared to be different in different concentration regimes.

**Se-Joung Bae, Hyun-Soo Kim, Yong-Il Hwang, Sun-Uk Choi. Cloning of transglutaminase gene from Streptomyces platensis YK-2 and its high expression in Streptomyces strains. J. Korean Soc. Appl. Biol. Chem. 55(3):417-422**

The microbial transglutaminase (TGase) gene, stgA, was cloned from Streptomyces platensis YK-2, which was newly isolated from a forest soil sample collected in Daegu, Korea. The gene was expressed in several Streptomyces strains including the original strain as the host. The stgA consisted of an open reading frame of 1,257 bp encoding a putative signal peptide of 29 amino acids, a pro-domain of 57 amino acids, and a mature TGase of 332 amino acids, and also had the putative active site of TGase, YGCVG. For expression of the stgA gene, a high expression vector was constructed via the insertion of the entire stgA gene including its putative ribosomal binding site into pSET152ET, located immediately downstream of a strong constitutive ermE\* promoter, and was introduced into several Streptomyces strains. The successful high expression and secretion of the correct StgA from streptomycetes were confirmed by electrophoretic sodium dodecyl sulfate polyacrylamide gel electrophoresis and N-terminal amino acid analysis.

**Geun-Hyoung Choi, Dal-Soon Choi, Su-Myeong Hong, Oh-Kyoung Kwon, Hee Soo Eun, Jeong-Han Kim, Jin Hyo Kim. Investigation on polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans and dioxin-like polychlorinated biphenyls in Korean fruits and dietary intake estimation. J. Korean Soc. Appl. Biol. Chem. 55(3):423-427**

Contamination levels of 17 polychlorinated dibenzo-p-dioxins (PCDDs)/polychlorinated dibenzofurans (PCDFs) and 12 dioxin-like polychlorinated biphenyls (DL-PCBs) were investigated on six major fruits consumed in Korea. Dioxin level was monitored on whole fruits. Average concentrations of PCDD/Fs were 0.042 pg/g fresh weight (f.w.) (apple), 0.0094 pg/g f.w. (grape), 0.1843 pg/g f.w. (mandarin orange), 0.2282 pg/g f.w. (peach), 0.1491 pg/g f.w. (pear), and 0.1330 pg/g f.w. (persimmon). For DL-PCBs, the average concentrations were 0.0932 pg/g f.w. (apple), 0.2649 pg/g f.w. (grape), 1.5437 pg/g f.w. (mandarin orange), 0.1942 pg/g f.w. (peach), 0.4591 pg/g f.w. (pear), and 0.4396 pg/g f.w. (persimmon). The major toxic equivalency (TEQ) contributors were identified as 1,2,3,7,8-pentachlorodibenzo-p-dioxin in PCDD and 2,3,4,7,8-pentachlorodibenzofuran in PCDFs. Most residual DL-PCBs showed no contribution to total TEQ values. The lowest TEQ level was recorded in peach (0.0161 pg-TEQWHO/g f.w.), and the highest TEQ level was found in mandarin orange (0.0448 pg-TEQWHO/g f.w.). Total estimated daily intake (EDI) of dioxins from the six fruits was calculated at 3.8159 pg-TEQWHO/day, which is 1.59% of Korean tolerable daily intake based on 60 kg body weight.

**Soon Ho Choi, Yeon Jeong Kim, Jong Tae Song, Hak Soo Seo. OsPrMC3 is involved in seed development and in determining seed yield as a branching inhibitor. J. Korean Soc. Appl. Biol. Chem. 55(3):429-432**

We here show that OsPrMC3 affects seed yields by regulating tillering. OsPrMC3 is highly expressed in leaves and mature seeds, although its expression is detected in all tissues, and its mutant osprmc3 has more tillers and less grain, indicating its crucial role in determining grain yield as a tillering inhibitor.

**Haejin Kim, Jin-Mu Yi, No Soo Kim, You Jin Lee, Jinhee Kim, Dal-Seok Oh, Se-Mi Oh, Ok-Sun Bang, Jun Lee. Cytotoxic compounds from the fruits of Vitex rotundifolia against human cancer cell lines. J. Korean Soc. Appl. Biol. Chem. 55(3):433-437**

Activity-guided fractionation of an ethanol extract from the fruits of Vitex rotundifolia led to the isolation of three flavonoids (**1**–**3**), one lignan (**4**), and three phenolic compounds (**5**–**7**). The structures of compounds **1**–**7** were identified by NMR data. The efficacy of all compounds was evaluated by their cytotoxic activities against nine human cancer cell lines using an in vitro assay.

**Suman Karki, Jin-Yong Kim, Si-Hyung Park, Hyung-Jin Kwon. Gene inactivation study on gntK, a putative C-methyltransferase gene in gentamicin biosynthesis from Micromonospora echinospora. J. Korean Soc. Appl. Biol. Chem. 55(3):439-442**

GntK harbors methyltransferase-related cobalamin-binding domain and radical S-adenosylmethionine domain. The gntK-inactivation mutant of Micromonospora echinospora accumulated higher levels of gentamicin Cla and lower levels of gentamicin C1 and C2 isomers compared to the wild-type strain. Based on these results, we propose that GntK is involved in C-methylation on C-6′ in gentamicin X2 but is dispensable in gentamicin biosynthesis.

**Ji Min Park, Jung-Keun Cho, Ji Ye Mok, In Hwa Jeon, Hyeon Soo Kim, Hyun Ju Kang, Seon Il Jang. Protective effect of astragalin and quercetin on ultraviolet (UV)-irradiated damage in HaCaT cells and Balb/c mice. J. Korean Soc. Appl. Biol. Chem. 55(3):443-446**

Co-treatment of astragalin and quercetin (AGQC) significantly suppressed the ultraviolet (UV)-induced keratinocyte damage. Administration of AGQC in UV-irradiated mice reduced the histological skin alterations and the levels of chemokine (C-X-C motif) ligand 1 (CXCL1) and CXCL2. These results suggest that AGQC has a potential use as a compound for protection against UV-irradiated skin damage.

**Eun Jung Lee, Young-Joon Ahn, Hoi-Seon Lee, Namhyun Chung. Biocontrol of pepper anthracnose by a new Streptomyces sp. A1022 under greenhouse condition. J. Korean Soc. Appl. Biol. Chem. 55(3):447-449**

A biocontrol agent including Streptomyces sp. A1022 was formulated into the form of a solid concentrate (SC) to evaluate its effect on anthracnose (Colletotrichum gloeosporioides) of pepper plants and was compared to that of commercial fungicide, azoxystrobin. Percent disease incidence was in the following order: untreated control > azoxystrobin > Streptomyces sp. A1022 SC. The average weight per pepper fruit was higher with Streptomyces sp. A1022 SC than those with azoxystrobin and the untreated control. The root length of the pepper plant postharvest was in the following order: Streptomyces sp. A1022 SC > azoxystrobin > the untreated control. Results showed that the pepper plants were more protected from anthracnose and under better growth conditions with Streptomyces sp. A1022 SC than with azoxystrobin and the untreated control.

**Hyun-Sang Jeon, Myung-Hun Jo, Heung-Joong Kim, Myoung-Hwa Lee, Sun-Kyoung Yu, Chun Sung Kim, Sook-Young Lee, Su-Gwan Kim, Hong Sung Chun, Euteum Park, Do Kyung Kim. Anticancer activities of diphenyl difluoroketone, a novel curcumin analog, on KB human oral cancer cells. J. Korean Soc. Appl. Biol. Chem. 55(4):451-456**

Effects of diphenyl difluoroketone (EF-24) and curcumin on cell growth and apoptosis induction in KB human oral cancer cells were examined. EF-24 and curcumin inhibited the growth of KB cells in a dose-dependent manner, and the potency of EF-24 was 30 times greater than that of curcumin. Treatment with EF-24 or curcumin resulted in nuclear condensation and fragmentation. EF-24 and curcumin promoted the proteolytic cleavage of procaspases-3, -7, and -9. Activities of caspases-3 and -7 were detected in living KB cells treated with EF-24 or curcumin. These results suggest that EF-24 and curcumin inhibit cell proliferation and induce apoptosis in KB human oral cancer cells, and have potential properties for development of anti oral cancer drug.

**Young-Su Park, Hee-Jun Park, Jaegwan Lee. Stabilization of glabridin by chitosan nano-complex. J. Korean Soc. Appl. Biol. Chem. 55(4):457-462**

Stabilization of glabridin, an isoflavan extracted from Glycyrrhiza glabra (licorice) root, was investigated in electrostatic complex prepared by glabridin and chitosan. Nanoparticles of the complex were spontaneously formed by adding glabridin into chitosan or three N-acylated chitosans which were synthesized by reacting chitosan with acid anhydride. N-acylated chitosans were characterized by Fourier transform infrared spectroscopy (FT-IR) and 1H-NMR. Degrees of N-acyl substitution of N-propionic, Nbutanoic, and N-hexanoic chitosan were 28.2, 34.74, and 35.02%, respectively. Transmission electron microscopy (TEM) showed the morphology of the complex particles was nano-scale spherical shape, and average size of the particles estimated by particle analyzer was between 32 and 42 nm. The electrostatic interaction between amino group of chitosan and hydroxyl group of glabridin was confirmed by the semi-doublet peak at 1590 nm−1 in FT-IR spectra. Maximum encapsulation efficiency of glabridin was found to be 84% when N-propionic chitosan with 1% glabridin was used for the preparation of nanoparticles, and the efficiency decreased upon increasing glabridin concentration. Stability of glabridin under UV-ray was enhanced after the complex formation with chitosan, and the enhancement was further augmented when Nacylated chitosan was used instead of chitosan. Long-term stability of glabridin in aqueous solution was also affected by the complex formation, and 2.2-fold stability enhancement at 25°C after 7-day incubation was observed in the case of N-hexanoyl chitosan. Chitosan or its derivatives could be used for the stabilization of polyphenolic compound such as glabridin and applied for the development of functional cosmetic products with skin-whitening effect.

**Soon-Mi Shim, Ji Yun Kim, Sang Mi Lee, Jin-Byung Park, Sea-Kwan Oh, Young-Suk Kim. Profiling of fermentative metabolites in kimchi: Volatile and non-volatile organic acids. J. Korean Soc. Appl. Biol. Chem. 55(4):463-469**

Gas chromatograph/mass spectrometry (GC/MS) analysis was carried out to determine both the volatile and nonvolatile organic acids in kimchi during 60 days of fermentation at 10°C. Principal component analysis (PCA) was applied to differentiate the pre-defined organic acids and lactic acid bacteria (LAB) during fermentation. Acetic acid was observed as dominant, which was vigorously produced until the middle of fermentation. Lactic acid was the major non-volatile organic acid in the kimchi and was produced throughout fermentation. In contrast, malic acid content decreased sharply at the initial stage of fermentation. Colony forming units of LAB in the kimchi, such as Leuconostoc, Lactobacilli, Pediococci, and Streptococci, were measured on selective media. Populations of Leuconostoc and Lactobacilli increased exponentially over 7 days of fermentation, indicating acetic acid and lactic acid were mainly produced by Leuconostoc and Lactobacilli. PCA demonstrated that acetic acid, propionic acid, lactic acid, butanoic acid, malic acid, Leuconostoc, and Lactobacilli were major components that differentiated the kimchi according to fermentation time.

**Md. Alamgir Hossain, Natcha Wongsrikaew, Gwi-Woong Yoo, Jaehong Han, Cha-Gyun Shin. Cytotoxic effects of polymethoxyflavones isolated from Kaempferia parviflora. J. Korean Soc. Appl. Biol. Chem. 55(4):471-476**

Although several studies covered anti-proliferative and cytotoxic effects of the rhizome extracts of Kaempferia parviflora Wall. Ex. Baker towards cancer cells, cytotoxicity of its pure methoxyflavone components remains undetermined. The present study was aimed to evaluate the cytotoxicity of 3,5,7,4′-tetramethoxyflavone (TeMF), 5,7,4′-trimethoxyflavone (TMF), and 5-hydroxy-3,7,3′,4′-tetramethoxyflavone (5-H-TeMF) purified from its rhizome extracts on human colorectal carcinoma (HCT-15) cells. All three compounds showed a dose-dependent inhibitory effect on HCT-15 cells. Significant numbers of apoptotic nuclei and condensed chromatin were also observed. TMF produced a higher level of fragmented DNA compared to TeMF and 5-H-TeMF. In addition TMF-treated cells showed the highest levels of caspase-3 activity than those treated with the other two compounds. Caspase-3 activity was reduced when Z-VAD-FMK, a caspase inhibitor, was administered along with each compound. Furthermore, caspase-3 activity was increased by the four concentrations of TMF in a dose-dependent manner. These results strongly suggest that TeMF, TMF, and 5-H-TeMF caused cell death via an apoptotic pathway. Therefore all these compounds have the potentiality to be the novel anti-cancer drugs.

**Sang Min Kim, Suk-Woo Kang, O-Nam Kwon, Donghwa Chung, Cheol-Ho Pan. Fucoxanthin as a major carotenoid in Isochrysis aff. galbana: Characterization of extraction for commercial application. J. Korean Soc. Appl. Biol. Chem. 55(4):477-483**

Fucoxanthin, a main marine carotenoid, in five species of fucoxanthin-containing microalgae, was quantified by high-performance liquid chromatography. Among the studied species, Isochrysis aff. galbana contained the highest amount of fucoxanthin (18.23 mg/g dried sample). This microalga showed good fucoxanthin extraction efficiency under the tested solvents (methanol, ethanol, acetone, and ethyl acetate), with the exception of n-hexane. In addition, most fucoxanthin (∼95%) could be extracted by a single extraction in ethanol within 5 min, and only 15% degradation of fucoxanthin was detected during ethanol extraction for 24 h. The two-phase solvent system of n-hexaneethanol-water with a volume ratio of 10:9:1 was determined to be the best system for the separation of fucoxanthin and lipids from extracts of I. aff. galbana. Under these conditions, fucoxanthin was fractionated in the hydroalcohol phase apart from the hexane phase containing lipids. These results imply that I. aff. galbana can be a commercial source for the spontaneous production of valuable fucoxanthins and lipids.

**Ji-Yeon Yang, Hoi-Seon Lee. Evaluation of antioxidant and antibacterial activities of morin isolated from mulberry fruits (Morus alba L.). J. Korean Soc. Appl. Biol. Chem. 55(4):485-489**

Antioxidant and antibacterial activities of materials isolated from the methanol extract of mulberry fruits were evaluated. The active constituent of the methanol extract derived from mulberry fruits was isolated by silica gel and LH-20 column chromatographies and was identified as morin by electron ionization mass spectrometer, 1H-NMR, and 13C-NMR spectroscopy. Based on the IC50 values, the antioxidant activities of morin exhibited potent inhibition according to 1,1-diphenyl-2-picrylhydrazyl (30.0 μg/mL) and 2,2’-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (71.0 μg/mL) radical scavenging assays. Furthermore, the antibacterial activity of morin showed moderate (++) inhibition against Streptococcus mutans at both 5 and 2 mg/disc, according to paper disc diffusion assays, indicating morin isolated from mulberry fruits could be a useful natural agent for the management of antioxidant and antibacterial treatments.

**Ji Hyun Sung, Jong Bin Kim, Sung Hyo Park, Seo Young Park, Jin Kyung Lee, Hoi-Seon Lee, Namhyun Chung. Berberine decreases cell growth but increases the side population fraction of H460 lung cancer cells. J. Korean Soc. Appl. Biol. Chem. 55(4):491-495**

Berberine has been reported to inhibit tumor growth in lung cancer. Thus, the effects of berberine on cancer cells as well as the cancer stem cell (side population; SP) fraction were investigated in the H460 lung cancer cell line, and the effects of berberine treatment on cell growth, cell cycle, and cell death were evaluated. Changes in the SP fraction were examined after treatment with berberine, 5-fluorouracil (5-FU), and co-treatment. Berberine inhibited cancer cell growth in a dose-dependent manner. Treatment of the cells with berberine resulted in a 4% increase in cell death and an 8% increase in the number of cells of G0/G1 phase, compared to the untreated control. To examine the relationship between berberine and cancer stem cells, the SP fraction was analyzed. Surprisingly, the SP cell fraction was increased upon berberine treatment and further increased after cotreatment with 5-FU. These results are in contrast to the study of Kim et al. (2008) with MCF-7 breast cancer cells, in which berberine inhibited the growth of both cancer cells and the corresponding cancer stem cells. Results of the present study suggest that berberine should be used with caution in the treatment of various cancers, despite its positive effect on cancer cell growth inhibition.

**Young Mee Kim, Huh Jung Sik, Moonjae Cho, Kyung Sue Shin. Development of a lentiviral vector and an efficient infection method for gene therapy for p22phox-defective chronic granulomatous disease. J. Korean Soc. Appl. Biol. Chem. 55(4):497-506**

Chronic granulomatous disease (CGD) is caused by impaired antimicrobial activity in phagocytes due to the absence or malfunction of the respiratory burst NADPH oxidase. In a previous study, we found that 12 patients from 10 unrelated families on Jeju Island had an identical homozygous single-base C-to-T substitution in exon 1 (c.7C > T) of CYBA, which encodes p22phox. Autosomal recessive p22phox-defective CGD carrierderived white blood cells were efficiently transduced by the elongation factor 1-alpha lentivirus constructs, as up to 90% of cells were green fluorescent protein (eGFP)-positive at 3 days post-transduction. pLL3.7-driven eGFP expression was stable for at least 4 weeks after transduction and persisted after CGD carrierderived cells were immortalized by human telomerase reverse transcriptase (hTERT) and B lymphoma Mo-MLV insertion region 1 (Bmi-1). Upon macrophage-like differentiation of the transduced HL-60 cells by dimethyl sulfoxide, up to 28% of the cells had higher mean levels of superoxide production than undifferentiated cells, and lentivirus efficiently transduced cells and induced the expression of genes for extended periods.

**Kiew-Ling Hii, Swee-Pin Yeap, Mat Don Mashitah. Pretreatment of pressed pericarp fibers (PPF) using alcohols as solvent to increase the accessibility of cellulose for cellulase production. J. Korean Soc. Appl. Biol. Chem. 55(4):507-514**

Organosolvents such as methanol, ethanol, propanol, ethylene glycol, polyethylene glycol, and glycerol, representing alcohols of different physical and chemical properties, were used to pre-treat the pressed pericarp fiber (PPF) to improve its susceptibility towards enzymatic hydrolysis. Experimental studies were carried out with 5 g of PPF, treated with 65% (w/w) alcohol solution, at high temperature (180°C) and pressure (10 bar N2). The performance of different alcohols pretreatment on PPF varied in term of lignin removal (% w/w), cellulose retained (% w/w), and hydrolysis (% w/w). Pretreatment with aliphatic propanol showed the highest lignin removal (53.18%) from PPF, leaving more accessible cellulose; followed by ethanol (48.18%), methanol (44.55%), polyethylene glycol (43.18%), ethylene glycol (40%), glycerol (25.46%), and water (18.18%). Generally, these results were in accordance to Hildebrand solubility parameters, in which the solubility of lignin in solvents increased when the Hildebrand parameter of solvent neared to the value of eleven. Propanol-treated-PPF also showed the highest hydrolysis (46.16%), which was confirmed by the release of more accessible cellulose after the pretreatment.

**Mi-Ra Yoon, Catherine W. Rico, Hee-Jong Koh, Mi-Young Kang. A study on the lipid components of rice in relation to palatability and storage. J. Korean Soc. Appl. Biol. Chem. 55(4):515-521**

For better understanding of the relationship between palatability and lipid components of rice, seven Korean rice varieties (Samkwang, Gopum, Chucheong, Ilpum, Palgong, Samnam, and Dobong), with a wide variation in palatability, were selected and analyzed for their lipid composition, including starch lipids, non-starch lipids, plant sterols, and lipase and lipoxygenase activities, as well as changes in the lipid properties of rice during storage. Samkwang and Dobong were shown to have the highest (77.2) and lowest (54.2) palatability scores, respectively, The rice varieties with high palatability scores showed significantly higher starch lipid and linoleic acid contents. Furthermore, they contained higher cycloartenol and lower concentrations of campesterol and stigmasterol. Low-palatable varieties exhibited higher activities of lipase and lipoxygenase. The palatability of all samples deteriorated after storage, which could be attributed to decreased concentrations of non-starch lipid and linoleic acid, increased oleic acid and palmitic acid contents, and increased amounts of squalene and phytosterols. These findings suggest that new lines of rice with enhanced palatability could be developed by modifying specific components in the lipid fraction of rice.

**Inmyoung Park, Jong-Dae Park, Hyun-Yu Lee, Jun-Seok Kum. Effects of air, microwave, and microvacuum drying on brown rice quality. J. Korean Soc. Appl. Biol. Chem. 55(4):523-528**

Proper hulling and drying are critical components of brown rice quality. Two medium grain rice varieties were examined for grain qualities including husking, cracking, germination ratio, color, hardness, and fat acidity after drying with 15, 30, and 45°C air, as well as at 100 and 200 W microwave, and microwavevacuum, respectively. Unlike impeller dehuller, rubber roller dehuller could not process rice with 22% moisture content. Brown rice varieties with 22% moisture content after dehulling were dried at 15, 30, and 45°C until moisture content reached 15%; the drying ratios for each temperature were 1.02, 2.55, and 3.46 %/h, respectively. When brown rice varieties were dried at below 30°C, no significant changes were observed in physico-chemical properties, whereas the cracking ratio increased significantly. Microwavevacuum drying resulted in higher reductions of germination ratio and fat acidity than with the microwave only at 100 W as well as reduced drying time over microwave drying.

**Hyoung-Su Park, Bom-Yi Sung, Kyung Ryu. Predictive model for growth of Staphylococcus aureus in blanched spinach with seasoning. J. Korean Soc. Appl. Biol. Chem. 55(4):529-533**

The safe storage time of blanched spinach with seasoning was determined using a predictive model of Staphylococcus aureus as a function of storage temperatures (5, 15, 20, 25, 30, 35°C). Storage of blanched spinach with seasoning at 5 and 15°C did not show any appreciable increase in the viable populations of S. aureus. At 20, 25, 30, and 35°C, a progressive increase in the viable populations of S. aureus was observed and increased more rapidly at 30 and 35dgC. A primary model (Gompertz model) was used to determine the determination coefficient (R2) values of lag time (LT) and specific growth rate (SGR). R2 values were not detected (ND) (5°C), 0.9777 (15°C), 0.9980 (20°C), 0.9949 (25°C), 0.9940 (30°C), and 0.9959 (35°C). A quadratic polynomial model equation could be proposed as a secondary model and was applied for lag time and SGR from primary modeling graphed as a function of storage temperature. The compatibility of the model was confirmed by calculating R2, mean square error (MSE), bias factor (Af), and accuracy factor (Bf) values as static parameters. For LT and SGR, R2 values were 0.9718 and 0.9789; MSE. 3.25 and 0.00; Af. 1.19 and 1.12; Bf, 1.05 and 1.02, respectively. These results indicate that the predictive model for S. aureus on blanched spinach with seasoning has a high statistical compatibility. Predicting S. aureus growth under different temperature storage conditions yielded safe storage times of blanched spinach with seasoning of 10, 10, 8, and 6 h for storage temperatures of 20, 25, 30, and 35°C, respectively.

**Won Kim, Woo Yeong Choe, Kwang Won Hong. Development of a lipase-based time temperature indicator system for monitoring ground beef quality. J. Korean Soc. Appl. Biol. Chem. 55(4):535-540**

A time-temperature indicator (TTI) based on Burkholderia cepacia lipase (BCL) activity was developed for monitoring ground beef quality under dynamic storage conditions. The growth of Pseudomonas spp., the major specific spoilage bacterium in meat, was used as a ground beef spoilage index. Arrhenius and logistic models were used to show temperature dependence of the growth of Pseudomonas spp. in ground beef. Under different isothermal conditions (25, 18, 12, and 5°C), the spoilage of ground beef by Pseudomonas spp. and the color change of the BCL-TTI had similar activation energies of 47.5 and 35.8 kJ/mol, respectively. The suitability of the BCL-TTI was validated for ground beef under two dynamic storage conditions using a predictive microbial growth model. The results showed that the endpoint of the BCL-TTI system was close to the end of the shelf life for ground beef with a relative error <10%. Therefore, the BCL-TTI system developed in this study could be useful as an effective tool for monitoring quality changes in ground beef during distribution and storage.

**Ji-Yeon Park, Angel Yang, Jong-Hyouk Park, A. M. Abd El-Aty, Jae-Ho Oh, Jung-Ah Do, Kisung Kwon, Ki-Hoon Shim, Ok-Ja Choi, Jae-Han Shim. Separation of multi-class pesticide residues from fatty food matrices prior to analysis using gas chromatography. J. Korean Soc. Appl. Biol. Chem. 55(4):541-549**

Separation of pesticides and other chemical contaminants from fatty food matrices prior to subsequent steps in the analytical process remains a challenging issue, and much effort has been invested to further enhance this method. The aim of the present study was to develop a simple multi-residue method involving a quick, easy, cheap, effective, rugged, and safe (QuEChERS) extraction method for the identification and quantification of 41 pesticide residues in cooked fatty food matrices, including heated soybean oil, roasted sesame, and boiled soybean using gas chromatography-micro/electron capture detector (GC-μECD). The analytes were subsequently confirmed via GC-mass spectrometry (MS). The responses of analytes were linear with excellent correlation coefficients (r 2) ranging from 0.993 to 1.000 (calculated from absolute peak areas). For the majority of the tested pesticides, the mean recoveries ranged from 68.5 and 121.4% with relative standard deviations ranging from 0.4 to 18.7%. Instrument limits of detection and quantification ranged from 0.004 to 0.30 μg/kg and 0.0125 to 1.00 μg/kg, respectively. The developed method presented in this study was applied successfully to determine pesticide residue levels in cooked fatty food matrices. None of the samples contained detectable amounts of pesticide residues.

**Gyu-Won Huh, Dae-Young Lee, Suh-Ji In, Don-Gil Lee, Sang Yong Park, Tae-Hoo Yi, Hee Cheol Kang, Woo-Duck Seo, Nam-In Baek. Fucosterols from Hizikia fusiformis and their proliferation activities on osteosarcoma-derived cell MG63. J. Korean Soc. Appl. Biol. Chem. 55(4):551-555**

Four fucosterol derivatives were isolated from the ethyl acetate fraction of Hizikia fusiformis. The chemical structures of the sterols were elucidated as fucosterol (**1**), a mixture of 24R,28R- and 24S,28R-epoxy-24-ethylcholesterol at the ratio of 3 to 2 (**2**), and 24R-saringosterol (**3**), all of which exhibited proliferation activity on MG63 cells.

**Sabina Shrestha, Ji-Hae Park, Dae-Young Lee, Jin-Gyeong Cho, Woo-Duck Seo, Hee Cheol Kang, Ki-Hyun Yoo, In-Sik Chung, Yong-Jin Jeon, Seung-Woo Yeon, Nam-In Baek. Cytotoxic and neuroprotective biflavonoids from the fruit of Rhus parviflora. J. Korean Soc. Appl. Biol. Chem. 55(4):557-562**

Six biflavonoids, succedaneaflavanone (**1**), mesuaferrone B (**2**), rhusflavanone (**3**), rhusflavone (**4**), agathisflavone (**5**), and cupressuflavone (**6**), were isolated from the fruits of Rhus parviflora. The chemical structures of the compounds were determined based on NMR, fast atom bombardment mass spectrometry, and IR. Biflavonoid compounds were evaluated for cytotoxicity against human cancer cell lines, including human colon carcinoma (HCT-116), human breast carcinoma (MCF-7), and human cervical carcinoma (HeLa). Biflavonoids **2**, **3**, and **5** showed significant cytotoxicity with IC50 values of 17.25 μM (mesuaferrone B against HCT-116), 17.50 μM (rhusflavone against MCF-7), and 15.20 μM (agathisflavone against HeLa). Compound **5** showed inhibition of β-secretase activity at a 10 μM concentration. Compound **6** showed inhibition of cyclin-dependent kinases (CDK2 and CDK5) with IC50 values of 18.58 and 9.29 μM, respectively.

**Sang-Sun Lim, Woo-Jung Choi, Hee-Myong Ro. Relationship between stability degree and chemical indices of livestock manure composts. J. Korean Soc. Appl. Biol. Chem. 55(4):563-566**

Principal chemical indices of compost associated with compost stabilization were investigated using relationship between stability degree (SD) and chemical indices including pH, electrical conductivity (EC), total C, extractable C, decomposability, total N, NH4 +, NO3 −, molar ratio of NH4 + to NO3 −, C/N, total P, and soluble P of various composts. Compost SD was positively (p<0.05) correlated with pH and C/N, and negatively (p<0.05) with EC, total N, and molar ratio of NH4 + to NO3 −. However, the correlation with pH, C/N, and total N were in contradiction to other studies that reported an opposite relationship to ours, probably due to different properties of initial composting materials. Therefore, the present study in conjunction with other studies suggest that EC and the molar ratio of NH4 + to NO3 − are the chemical indices closely associated with stabilization of composts regardless of composting materials.

**Min-Gi Kim, Ji-Yeon Yang, Nam-Hyun Chung, Hoi-Seon Lee. Photo-response of tobacco whitefly, Bemisia tabaci gennadius (hemiptera: Aleyrodidae), to light-emitting diodes. J. Korean Soc. Appl. Biol. Chem. 55(4):567-569**

The photo-response of the tobacco whitefly to light-emitting diodes of four different wavelengths and various intensities was tested in an LED-equipped Y-maze chamber and compared with the response to black light (BL), which is typically used in commercial traps. The BL showed the highest attraction rate (90.3%) to Bemisia tabaci, followed by a similarly strong attraction to the blue LED (89.0%), the yellow LED (87.7%), the green LED (85.3%), and the red LED (84.3%). These results suggest that energy-efficient LEDs could be used for more environmentally friendly insect control.

**You Ri Yang, Young Cheol Kim, Se Won Lee, Si Woo Lee, Gwang Guk An, In Seon Kim. Involvement of an efflux transporter in prochloraz resistance of Fusarium fujikuroi CF245 causing rice bakanae disease. J. Korean Soc. Appl. Biol. Chem. 55(4):571-574**

Rice bakanae disease pathogens resistant to conazole fungicide prochloraz have been reported in Korea. Understanding fungal response associated with the resistant is required for successful control of the disease. Investigation of prochlorazresistant responses of the rice bakanae disease pathogen, Fusarium fujikuroi, showed significant growth inhibition of the resistant strain after sodium azide treatment suggested involvement of the ABC transporter in fungal prochloraz-resistant responses. Prochloraz degradation was accompanied by fungal growth, dependently on sodium azide treatment. Partial sequence analysis of the ABC transporter gene confirmed that the resistant strain possesses an efflux transporter with high sequence similarity to genes of conazole fungicide-resistant pathogens. These results suggest that the prochloraz-resistant responses of F. fujikuroi CF245 involve an efflux transporter.

**Woo Duck Seo, Jun Young Kim, Ki Chang Jang, Sang-Ik Han, Ji-Eun Ra, Seong-Hwan Oh, Jin Hwan Lee, Yun-Geun Kim, Hyeon-Jung Kang, Byung-Joo Kim, Min-Hee Nam. Anti-pigmentation effect of serotonin alkaloid isolated from Korean barnyard millet (Echinochola utilis). J. Korean Soc. Appl. Biol. Chem. 55(5):579-586**

Investigation of the melanogenesis inhibitory effect of barnyard millet grain extracts (BME) led to isolation of compounds against mushroom tyrosinase and B16 melanoma cells. Chromatography yielded five phenolic compounds, among which n-p-coumaroyl serotonin (1, CS) exhibited potent non-competitive inhibition (IC50 =8.8 μM) compared with that of kojic acid (IC50=14.6 μM) against mushroom tyrosinase. More importantly, CS decreased melanin content to eight times lower (IC50 =11.6 μM) in B16 melanocytes than that of feruloyl serotonin (2, FS, IC50 =86.5 μM) without cytotoxicity. CS significantly inhibited the protein expression of tyrosinase, tyrosinase-related protein-1 (TRP-1), TRP-2, and microphthalmia-associated transcription factor using immunoblotting. Furthermore, molecular docking simulations were also carried out to investigate the structure related to the inhibitory activities. Therefore, BME can be used as a natural source of depigmentation to prevent melanogenesis.

**Hyung Won Ryu, Ji Hye Lee, Jae Eun Kang, Young Min Jin, Ki Hun Park. Inhibition of xanthine oxidase by phenolic phytochemicals from Broussonetia papyrifera. J. Korean Soc. Appl. Biol. Chem. 55(5):587-594**

The roots of Broussonetia papyrifera were extracted into four different polar solvents: chloroform, 50% ethanol in water, ethanol, and water. The ethanol extract showed the most potent inhibition (72.3% at 20 g/mL) against xanthine oxidase (XOD). Chromatography of EE yielded nine phenolic phytochemicals, which were confirmed as broussochalcone A (**1**), broussochalcone B (**2**), 3,4-dihydroxyisolonchocarpin (**3**), 4-hydroxyisolonchocarpin (**4**), 3-′(3-methylbut-2-enyl)-3′,4′,7-trihydroxyflavane (**5**), kazinol A (**6**), kazinol B (**7**), kazinol E (**8**), and broussoflavan A (**9**). All isolated compounds (**19**) possessed potent antioxidant activities against 2,2-diphenyl-l-picrylhydrazyl and 2,2′-azino-bis-ethylbenzthiazoline-6-sulfonic acid (ABTS) radicals with IC50 values ranging from 5.8 to 252.8M. Although most compounds exhibited potent inhibition with IC50 values ranging 0.6–164 M against XOD, compounds **1** and **3** were found to be the principal contributors to the XOD inhibition in ethanol extract. The analysis of K I and K IS values proved that the two most promising compounds (**1** and **3**), present at high concentrations in the root barks as analyzed by using high-performance liquid chromatography analysis, were reversible mixed type I inhibitors.

**Young Mee Kim, Kyung Sue Shin, Moonjae Cho. New method for detection of p22-phox-deficient chronic granulomatous disease heterozygote carriers in Jeju. J. Korean Soc. Appl. Biol. Chem. 55(5):595-598**

Chronic granulomatous disease (CGD) is a genetically heterogeneous disease caused by defects in the genes encoding any one of the NADPH oxidase components. The estimated prevalence of CGD is between 1 in 200,000 and 1 in 250,000 individuals, with variable rates in different countries. According to a compilation by the Korean College of Pediatric Clinical Immunology, the prevalence of CGD in Korea is 0.9 in 1,000,000 individuals. Surprisingly, the prevalence of CGD in Jeju Island is 20.7 in 1,000,000 individuals. We reported an identical homozygous single-base substitution of C to T in exon 1 (c.7C > T) of the CYBA gene from 12 CGD patients in Jeju Island. We hypothesized that the high prevalence of CGD in Jeju Island is associated with an identical mutation inherited from a common ancestor or proband. The aim of this study was to develop an assay to detect heterozygote carriers of the genotype specific to Jeju Island. We developed three specific primers, and nested polymerase chain reaction was employed using whole blood samples as a source of genomic DNA. Using the new detection method, 704 individuals were tested, 9 of which were detected as carriers, and the expected number of carriers is 1.3 in 100 individuals.

**Myoung-Ho Shin, Chang-Hwan Kim, Min-Kyun Kim. Classification of halophyte community growth and its relationship with soil chemical properties in Saemanguem reclaimed land. J. Korean Soc. Appl. Biol. Chem. 55(5):599-605**

Halophyte communities have been established to reduce dust from the Saemangeum reclaimed land. Growth of large-scale artificial halophyte communities was assessed, and the relationship between halophyte community growth and soil chemical properties was examined through three-year halophyte monitoring and soil analysis. Halophyte community growth was classified in 230 quadrats from 2006 to 2008, and the statistical significance between halophyte community growth and soil chemical properties was determined by Duncan’s multiple range test. Overall, the yearly percentage of Class1 and Class 2 quadrats increased from 40% in 2006 to 87% in 2008. Over 90% of the 29 common quadrats consecutively surveyed for three years belonged to Class 1 or Class 2. Soil electrical conductivity (EC) decreased from 3.3 dSm−1 in 2006 to 2.0 dSm−1 in 2008. Available phosphate content increased from 28 mg kg−1 in 2007 to 115 mg kg−1 in 2008. Among soil properties, soil EC had a significantly negative relationship with halophyte community growth. A significant relationship was also observed between halophytic height and soil EC (R2=0.95). These results indicate that halophyte community growth could be classified into five classes based on plant height and coverage closely related to soil EC in the reclaimed land.

**Jong-Hui Lim, Chang-Hwan An, Yo-Hwan Kim, Byung-Kwon Jung, Sang-Dal Kim. Isolation of auxin- and 1-aminocyclopropane-1-carboxylic acid deaminase-producing bacterium and its effect on pepper growth under saline stress. J. Korean Soc. Appl. Biol. Chem. 55(5):607-612**

Plant tissues produce ethylene under the environmental stresses such as drought, salinity, and heavy metals. Ethylene concentration can be reduced by 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase produced by plant growth-promoting rhizobacterium (PGPR), which cleaves the ethylene precursor ACC. The present study focused on alleviation of environmental stress by selected PGPR, which could suppress fungal plant disease. These PGPRs were capable of utilizing ACC as sole source of nitrogen and also produced auxin. Seed germination of red pepper was reduced with increasing salt concentration, and approximately 98.2% of seeds germinated in the absence of salt, whereas only 36.2% seeds germinated in the presence of 175 mM NaCl. Seed germination was also decreased by 62.1 and 19.9% in the presence of 120mM NaCl and 120mM NaCl +ACC deaminase-producing PGPR Pseudomonas fluorescens 2112, respectively, compared to uninoculated control. The effect of salinity stress with different salt concentration on pepper plants and their alleviation with PGPR was evaluated. Non-inoculated pepper plants died after 5 week when grown in the presence of high salt (120 mM NaCl), whereas 80% of pepper plants inoculated with P. fluorescens 2112 survived under the high salt stress. Salt stress also decreased the fresh and dry weights of pepper grown, compared to the negative control, whereas pepper plants inoculated with P. fluorescens 2112 retained the biomass similar to control plants. These results indicate that ACC deaminase and auxin producing P. fluorescens 2112 is a multi-functional PGPR that can promote the growth and development of pepper plants by alleviating the high-salt stress.

**Jong-Su Seo. Multiple pathways in the degradation of dibenzothiophene by Mycobacterium aromativorans strain JS19b1T. J. Korean Soc. Appl. Biol. Chem. 55(5):613-618**

Mycobacterium aromativorans JS19b1T, isolated from a polycyclic aromatic hydrocarbon (PAH)-contaminated site in Hilo, Hawaii, USA, was studied for its degradation of dibenzothiophene (DBT) as a sole carbon source. Strain JS19b1T degraded 100% of DBT (40 mg/L) within 11 days incubation through branched metabolic pathways, including dioxygenation on C-1,2 and C-3,4 positions and monooxygenation on sulfur atom. The metabolites were isolated and identified by gas chromatography-mass spectrometry. Dibenzothiophene-5,5′-dioxide was transformed from sulfur oxidation of DBT. Cis-dibenzothiophene dihydrodiols were detected as initial dioxygenation products. Two ring cleavage products of dibenzothiophene diols were detected as trans-4-(3-hydroxybenzo[b]thiophen-2-yl)-2-oxobut-3-enoic acid and trans-4-(2-hydroxy-benzo[b]thiophen-3-yl)-2-oxobut-3-enoic acid, which could be produced by meta-cleavage of dibenzothiophene-1,2-diol and dibenzothiophene-3,4-diol, respectively. The detection of benzothienopyranone strongly supported that M. aromativorans JS19b1T can degrade DBT through 1,2- and/or 3,4-dioxygenations followed by meta-cleavage. The ring cleavage products were further transformed into 2,2′-dithiosalicylic acid via 2-mercaptobenzoic acid. These results suggested that strain JS19b1T has diverse lateral dioxygenase and metabolic enzyme systems. The diverse DBT metabolic pathways in JS19b1T gave a new insight to the bacterial degradation of aromatic compounds.

**Hyang-Mok Ok, Sang-Mi Kim, Joo-Won Park, Kab-Sig Kim, Han-Kyul Nam, Ji Yeon Kim, Oran Kwon. Development of nanoparticulate formulation of coenzyme Q10 and comparison of plasma coenzyme Q10 response in a single supplementation with regular coenzyme Q10 using rats. J. Korean Soc. Appl. Biol. Chem. 55(5):619-623**

Bioavailability of a nanoparticulate formulation of coenzyme Q10 (NQ20), which has high stability in the water phase, was evaluated. The particle size was 188 nm, and the zeta potential value was between −38.8 and −44.8 mV at 4, 25, and 40°C in distilled water after eight weeks storage. Bioavailability of NQ20 was compared with a commercial coenzyme Q10 in oil and water phases as emulsified form using male Sprague-Dawley rats. After single oral administration of each coenzyme Q10 solution, the blood of rats was collected at 0, 1, 2, 3, 4, 5, 6, 9, and 12 h, and the concentrations of coenzyme Q10 were analyzed by high performance liquid chromatography. The plasma coenzyme Q10 levels at 1, 2, and 12 h were significantly higher when the rats were administered NQ20 compared to coenzyme Q10 in oil. The maximum plasma concentration (C max) and area under the concentration-time curve (AUC) values for NQ20 were 1.10±0.18 and 5.92±1.11 mM·h/mL, whereas the Cmax and AUC of coenzyme Q10 in oil were 0.79±0.07 and 5.30±0.62 mM·h/mL, respectively (p >0.05). Due to high absorbability and small particle size, NQ20 was found to have similar bioavailability to commercial coenzyme Q10 in the oil phase. Results indicate applicability of NQ20 in the food industry, particularly in beverages.

**Woo-Seok Jang, No-Joon Song, Hyang-Jin Yoon, Min-Ji Kim, Jin-Mo Ku, Joung-Woo Hong, Young Min Lee, Ki-Moon Park, Kye Won Park. Identification of Sedum kamtschaticum, Lythrum anceps, and Astilbe chinensis var. davidii as inhibitors of peroxisome-proliferator-activated receptor γ expression and lipid accumulation. J. Korean Soc. Appl. Biol. Chem. 55(5):625-631**

Screening of wild vegetable extracts led to isolation of Sedum kamtschaticum, Lythrum anceps, and Astilbe chinensis var. davidii as putative anti-adipogenic herbal extracts. Cell viability, lipid accumulation, and adipocyte marker expression were determined to validate the effects of the selected extracts on adipogenesis. All extracts suppressed lipid accumulation in C3H10T1/2 cells, primary mouse embryonic fibroblasts, and 3T3-L1 cells in a dose-dependent manner. These extracts inhibited mRNA expression of peroxisome proliferator-activated receptor gamma (PPARγ) and its downstream target genes such as adipocyte protein 2 (aP2), lipoprotein lipase, adiponectin, and CD36. Treatment with these extracts also consistently suppressed PPARγ and aP2 protein expressions. Additionally, these extracts generated from different parts and/or various harvest periods similarly inhibited adipocyte differentiation. Results showed the extracts have potential beneficial roles in obesity and related metabolic syndromes.

**Shin Jung Park, Sun-Hee Hyun, Hyo Won Suh, Seok-Young Lee, Tae-Sun Min, Joong-Hyuck Auh, Hong-Jin Lee, Jung-Hyun Kim, Soo-Muk Cho, Hyung-Kyoon Choi. Differentiation of black raspberry fruits according to species and geographic origins by genomic analysis and 1H-NMR-based metabolic profiling. J. Korean Soc. Appl. Biol. Chem. 55(5):633-642**

Random amplification of polymorphic DNA (RAPD) and NMR techniques were used to differentiate and identify species of black raspberry (BR) of different geographic origins. BR leaf samples from five geographic origins were identified as Rubus japonicus and R. coreanus by RAPD. 1H-NMR analysis was also performed for BR fruit extracts from different geographic origins. Major compounds assigned in 1H-NMR spectra of BR fruits were amino acids, organic acids, sugars, phenolic acids, and purine derivatives. In addition, relative levels of total phenolic compounds, flavanols, flavonoids, and anthocyanins in the BR fruits were further analyzed. Hierarchical cluster analyses (HCA) based on the genetic (RAPD of leaf samples) and metabolic (1HNMR, total phenolic compounds, flavanols, flavonoids and anthocyanins of fruit samples) datasets were independently performed. The HCA dendrogram pattern derived from RAPD genetic fingerprinting of BR leaf samples matched that from the 1H-NMR data of BR fruit samples. This research demonstrates that metabolic profiling of BR fruit based on 1H-NMR is a promising method for differentiating BR fruits of various species and geographic origins.

**Seong Yeong Kim, Ho Lee. Effects of quality characteristics on milled rice produced under different milling conditions. J. Korean Soc. Appl. Biol. Chem. 55(5):643-649**

Optimum moisture content and temperature, as well as physical and chemical properties, of brown rice were determined for production of high quality milled rice. Moisture content losses (%) were highest (5.69 and 5.61%) in milled rice produced from brown rice with 17 and 19% moisture contents at 40°C kernel temperature, whereas showed the lowest value (0.58%) in milled rice produced from brown rice with 13% moisture content at 0oC. The ratio of broken kernels was relatively higher in milled rice produced from brown rice with 17 and 19% moisture contents regardless of kernel temperatures. Milled rice produced from the brown rice at relatively lower kernel temperatures (0, 10, and 20°C) and moisture contents (11, 13, and 15%) showed relatively higher L values and lower a and b values when compared with the higher kernel temperatures (30 and 40°C) and moisture contents (17 and 19%) rice. Whiteness of milled rice showed relatively higher values in milled rice produced from brown rice with 11 and 13% moisture contents regardless of kernel temperatures. Brown rice with 11–13% moisture and 0–20°C kernel temperature when milled enhanced the quality of milled rice, whereas detrimental effect was found when the brown rice with moisture content of above 15% and high kernel temperatures (30 and 40°C) were milled.

**Wan-Shin Jo, Hye-Yeon Song, Nak-bum Song, Kyung Bin Song. Preparation of a cotton seed meal protein/nanoclay composite film containing carvacrol and its effect on the growth of escherichia coli O157:H7 inoculated on bacon during storage. J. Korean Soc. Appl. Biol. Chem. 55(5):651-656**

Cottonseed meal protein (CSP) film containing nanoclay and carvacrol was prepared, and the physical properties of the film were investigated. Nanoclay (Cloisite Na+) incorporation improved mechanical properties of the CSP film. CSP film containing 3% nanoclay had tensile strength of 4.07 MPa and elongation at break of 26.37%. The optimal condition for the CSP film manufacturing was 3 g cottonseed protein, 3 g fructose, and 0.09 g Cloisite Na+ in 100 mL of film-forming solution. To inhibit the growth of pathogenic bacteria such as Escherichia coli O157:H7, CSP film containing carvacrol was prepared, and microbial growth was examined during bacon packaging and storage using the film. The antimicrobial activity of the CSP film against E. coli O157:H7 increased with increasing carvacrol concentration. After 10 d of storage, the population of E. coli O157:H7 inoculated on the bacon samples packed with the CSP film containing carvacrol decreased by 1.57 log CFU/g compared to the control. These results suggest that the CSP film containing carvacrol can be used as an antimicrobial packaging film.

**Tae Woong Na, Md. Musfiqur Rahman, Angel Yang, Ki Hun Park, A. M. Abd El-Aty, Jae-Han Shim. Residual pattern of acequinocyl and hydroxyacequinocyl in perilla leaf grown under greenhouse conditions using ultra performance liquid chromatography-photo diode array detector with tandem mass confirmation. J. Korean Soc. Appl. Biol. Chem. 55(5):657-662**

Persistence and degradation behaviors of acequinocyl and hydroxyacequinocyl were determined in perilla leaf grown under greenhouse conditions. Acequinocyl (15%, SC) was sprayed on perilla leaf at the recommended dose rate of 37.5 g/250 L water/10a with single and double dose applications. Leaf samples were collected randomly at 0 (2 h after application), 1, 3, 5, and 7 days post-application from two different plots. The samples were extracted with acetonitrile, purified through a solid phase extraction procedure, and analyzed via ultra performance liquid chromatography coupled with photo diode array detector (UPLCPDA). Residues were confirmed via liquid chromatography tandem mass spectrometry (LC-MS/MS) in positive-ion electrospray ionization (ESI+) mode. Calibration curves were linear over the concentration ranges for the analytes with r 2 ≥0.992. The limits of detection and quantification were 0.05 and 0.165 mg/kg for both acequinocyl and hydroxyacequinocyl. The method was validated in triplicate at two fortification concentrations in the matrix. Good recoveries were observed for the target analytes, ranging between 94.95 and 113.26% with relative standard deviations less than 6%. The rates of disappearance of total acequinocyl on perilla leaf for single and double doses were described as first-order kinetics with half-lives of 2.8 and 3.1-days, respectively.

**Min-Jeong Kim, Takuya Nihira, Sun-Uk Choi. Cloning and characterization of afsR homologue regulatory gene from Streptomyces acidiscabies ATCC 49003. J. Korean Soc. Appl. Biol. Chem. 55(5):663-668**

Global regulator for secondary metabolism, AfsR, is phosphorylated by the serine/threonine kinase AfsK. Phosphorylation of AfsR activates the transcription of afsS, resulting in the increased production of secondary metabolites in Streptomyces strains. We isolated an afsR homologue regulatory gene from Streptomyces acidiscabies ATCC 49003, which produces thaxtomin A and WS5995B as secondary metabolites. To examine the function of afsR in the production of secondary metabolites in S. acidiscabies, an intact 2,976 bp open reading frame of afsR was identified and characterized. In S. lividans TK 24 strain, the exconjugant harboring afsR high expression vector, began to generate actinorhodin at 36 h of culture, and the amount of accumulated actinorhodin became 10-fold higher than that of the exconjugant harboring the vector lacking the afsR gene. To clarify the in vivo function of afsR, an afsR-disrupted mutant was constructed and analyzed. No morphological difference was observed between the wild-type strain and the afsR disruptant, but production of thaxtomin A and WS5995B of the afsR disruptant were significantly decreased compared to those of the wild-type strains. Specially, WS5995B production was almost abolished by the disruption of only the afsR gene. These changes were restored to the original wild-type phenotype by the introduction of the intact afsR gene into the afsR disruptant, suggesting that the afsR gene participates in the production of secondary metabolites of S. acidiscabies.

**Soon Young Shin, Seunghyun Ahn, Mi Joo Park, Hyuk Yoon, Mihyang Kim, Sang Yun Ji, Dongsoo Koh, Young Han Lee, Yoongho Lim. Structure-activity relationships of polyphenols inhibiting lipopolysaccharide-induced NF-κB activation. J. Korean Soc. Appl. Biol. Chem. 55(5):669-675**

Most plant-derived phenolic compounds are synthesized as secondary metabolites in plants due to their defense strategies. Previous studies have reported the inhibitory effect of chalchones, one of polyphenols, on nuclear factor kappa-light-chain-enhancer of activated B cell (NF-κB)-dependent transcriptional activities in various cancer cells. However, detailed relationship between the structure and biological activity on the inhibition of NF-κB in the microglia is less defined. In this study, twenty-two polyphenols including sixteen hydroxy/methoxy chalcones, four 2H-chromenes, and two N-phenylacetamides were synthesized. Lipopolysaccharide (LPS) is a constituent of the outer membrane of the Gramnegative bacteria, which is widely employed as a proinflammatory stimulus in many experimental settings. The effects of polyphenol compounds synthesized on the inhibition of LPS-induced NF-κB activity in BV2 microglial cells were investigated, and the structural conditions to show better inhibitory effects were evaluated. Western blot analysis was performed on compounds showing good inhibitory effects.

**Bong-Gyu Kim, Jae Young Kim, Yongsub Yi, Yoongho Lim. Biotransformation of eugenol to bis-eugenol by Kalopanax pictus cell culture. J. Korean Soc. Appl. Biol. Chem. 55(5):677-680**

So far, the production of bis-eugenol has been conducted by chemical synthesis. However, because chemical synthesis of bis-eugenol has disadvantages such as regioselectivity and low yield, an environmentally friendly production of bis-eugenol by biological synthesis has become attractive. In the present study, bis-eugenol was produced using Kalopanax pictus callus culture. High-performance liquid chromatography analysis of reaction product revealed a new peak, whose structure was determined to be bis-eugenol by nuclear magnetic resonance spectroscopy. After 18 h of biotransformation using K. pictus cell, 16.3 mg/L of biseugenol was produced without any byproducts. This is the first report on production of bis-eugenol by biotransformation using plant cell culture.

**Kyoung-Shik Cho, Hoi-Seon Lee. Visual preference of diamondback moth, Plutella xylostella, to light-emitting diodes. J. Korean Soc. Appl. Biol. Chem. 55(5):681-684**

The phototactic response of diamondback moth, Plutella xylostella, to six light-emitting diodes (LEDs) was evaluated, and its response was compared with a commercial luring lamp (BLB). Based on the attraction rate under optimal conditions, green (98.3%) gave the best attractive activity of LEDs, followed by UV (90.0%), red (79.4%), yellow (76.7%), blue (69.4%) and IR (36.7%). P. xylostella showed higher preference to green LED than BLB (86.7%).

**Song Yi Koo, Kwang Hyun Cha, Dae-Geun Song, Dong-Un Lee, Cheol-Ho Pan. Increased sulforaphane concentration in brussels sprout following high hydrostatic pressure treatment. J. Korean Soc. Appl. Biol. Chem. 55(5):685-687**

High hydrostatic pressure (HHP) treatment was used to increase the concentration of sulforaphane in Brussels sprout, a cruciferous vegetable known to have health benefits. The highest concentration of sulforaphane was 1021.8 μmol per kg fresh weight of Brussels sprouts after HHP treatment at 500 MPa, which corresponded to a 317% increase compared to the HHP-untreated control.

**Sabina Shrestha, Dae-Young Lee, Ji-Hae Park, Jin-Gyeong Cho, Woo-Duck Seo, Hee Cheol Kang, Yong-Jin Jeon, Seung-Woo Yeon, Myun-Ho Bang, Nam-In Baek. Flavonoid glycosides from the fruit of Rhus parviflora and inhibition of cyclin dependent kinases by hyperin. J. Korean Soc. Appl. Biol. Chem. 55(5):689-693**

Chrysoeriol-7-O-β-d-glucopyranoside (**1**), luteolin-7-O-β-d-glucopyranoside (**2**), quercetin-3-O-β-d-glucopyranoside (**3**), quercetin-3-O-β-d-galactopyranoside (**4**), and quercetin-3-O-α-l-rhamnopyranoside (**5**) were isolated for the first time from the fruits of Rhus parviflora. The chemical structures of the compounds were determined using nuclear magnetic resonance, fast atom bombardment mass spectrometry, and infrared spectroscopy. Compound **4** (hyperin) inhibited cyclin dependent kinases (CDK2 and CDK5) in vitro with IC50 values of 21.02 and 10.28 μM, respectively.

**Ramasamy Rajesh Kumar, Jae Taek Lee, Jae Young Cho. Fate, occurrence, and toxicity of veterinary antibiotics in environment. J. Korean Soc. Appl. Biol. Chem. 55(6):701-709**

The increasing worldwide usages of Veterinary Antibiotics (VAs) for therapeutic and nontherapeutic are becoming serious issue due to its adverse effects on all living organisms. Release of VAs into the aquatic and terrestrial environments results in antibiotic resistance in bacteria and toxicity to humans, animals, and plants. This review covers the present scenario on VA usage, occurrence, toxicity, and removal techniques.

**Bombi Lee, Bongjun Sur, Jinhee Park, Heungsop Shin, Sunoh Kwon, Mijung Yeom, Seok Joong Kim, Kyungsoo Kim, Insop Shim, Chang Shik Yin, Hyejung Lee, Dae-Hyun Hahm. Fucoidan ameliorates scopolamine-induced neuronal impairment and memory dysfunction in rats via activation of cholinergic system and regulation of cAMP-response element-binding protein and brain-derived neurotrophic factor expressions. J. Korean Soc. Appl. Biol. Chem. 55(6):711-720**

Effect of fucoidan (FCN) treatment on improving memory defects caused by administration of scopolamine (SCO) to the rats was examined. The effects of FCN on the acetylcholinergic system as well as the expression of cAMP-response elementbinding protein (CREB) and brain-derived neurotrophic factor (BDNF) mRNAs in the hippocampus were also investigated. Male rats were administered daily doses for 14 days of FCN (10, 20, and 50 mg/kg, i.p.) 30 min before scopolamine injection (2 mg/kg, i.p.). Daily administration of FCN improved memory impairment as measured by the passive avoidance test (PAT) and reduced the escape latency for finding the platform in the Morris water maze (MWM) test. Administration of FCN significantly alleviated memory-associated decreases in cholinergic immunoreactivity and restored the expression level of BDNF and CREB mRNAs in the hippocampus. Additionally, FCN significantly decreased the expression of pro-inflammatory cytokines such as interleukin-1β (IL-1β) and tumor necrosis factor-α (TNF-α) mRNAs in the hippocampus. These results demonstrated that FCN has significant neuroprotective effects against neuronal impairment and memory dysfunction caused by scopolamine in rats. Thus, these findings suggest that FCN is useful as a therapeutic agent for improving cognitive functioning via stimulation of cholinergic enzyme activities and regulation of CREB and BDNF expressions in the brain.

**Joo Young Lee, Sang Min Kim, Woo-Suk Jung, Dae-Geun Song, Byung-Hun Um, Jin-Ki Son, Cheol-Ho Pan. Phlorofucofuroeckol-A, a potent inhibitor of aldo-keto reductase family 1 member B10, from the edible brown alga Eisenia bicyclis. J. Korean Soc. Appl. Biol. Chem. 55(6):721-727**

Aldo-keto reductase family 1 member B10 (AKR1B10) belongs to a superfamily of NADPH-dependent aldo-keto reductases and is considered a biomarker of several cancers. Inhibition of recombinant human AKR1B10 (rhAKR1B10) was assayed using 31 seaweed extracts, among which, an Eisenia bicyclis extract was selected for further study. To identify the compounds in E. bicyclis responsible for inhibitory effects on rhAKR1B10, five compounds were isolated by bioactivity-guided fractionation and isolation. Among them, phlorofucofuroeckol-A (PFF-A), isolated from an ethyl acetate fraction, exhibited the greatest inhibition of rhAKR1B10. The inhibitory rate of PFF-A against rhAKR1B10 was 61.41% at 10 μM, with an IC50 of 6.22 μM. Enzyme kinetic analyses revealed non-competitive inhibition with a K D of 2.76 μM. These results indicate that PFF-A from E. bicyclis may be a promising anticancer agent.

**Wan-Taek Ju, Van Nam Nguyen, Woo-Jin Jung, Kil-Yong Kim, Ro-Dong Park. Purification and characterization of a β-N-acetylhexosaminidase from wheat bran and its applicability to biocontrol of Fusarium solani. J. Korean Soc. Appl. Biol. Chem. 55(6):729-735**

N-acetyl-β-d-hexosaminidase was purified from wheat bran and characterized. The purified enzyme showed two protein bands on sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) with molecular mass of 75 and 78 kDa. The enzyme exhibited optimum pH and temperature at 5.0 and 50°C, respectively. The enzyme was active on the substrates of p-nitrophenyl-N-acetyl-β-d-glucosaminide (pNP-GlcNAc) and p-nitrophenyl-N-acetyl-β-d-galactosaminide (pNP-GalNAc), whereas inactive on pNP-β-d-glucopyranoside, pNP-β-d-galactopyranoside, swollen chitin, and colloidal chitin, suggesting high substrate specificity. The enzyme activity for pNP-GlcNAc was stable at pH 3–6 and under 50°C. The K m , V max and K cat for pNP-GlcNAc were 0.014 mM, 0.05 μmol/min, and 3.01×106 min−1, respectively. The enzyme could be completely inhibited at 1–10 mM HgCl2 and AgNO3, suggesting that the intact thiol group is essential for activity. β-N-Acetylhexosaminidase from wheat bran could inhibit the conidial germination and digest the hyphae of Fusarium solani.

**Lingzhu Meng, Seung Hwan Yang, Tae-Jong Kim, Joo-Won Suh. Effects of two putative LacI-family transcriptional regulators, SCO4158 and SCO7554, on antibiotic pigment production of Streptomyces coelicolor and Streptomyces lividans. J. Korean Soc. Appl. Biol. Chem. 55(6):737-741**

Streptomycetes produce many secondary metabolites, including antibiotics, antifungal agents, anti-parasitic drugs, and immune suppressors. Evaluation of streptomycetes, Streptomyces coelicolor and Streptomyces lividans, was carried out as research models. Overexpression of the putative LacI-family transcriptional regulator SCO4158 enhanced the production of antibiotic pigments in S. coelicolor but decreased their production in S. lividans, which serves as an example of discrepancy between two closely related strains. The comparison of biological mechanisms of the SCO4158 protein between these two strains represents a potential approach for the identification of S. coelicolor and S. lividans genes involved in antibiotic pigment production. Overexpression of the putative LacI-family transcriptional regulator SCO7554 either decreased (homologous gene from the same overexpression strain) or enhanced (heterologous gene from the other strain) antibiotic pigment production by the homologous SCO7554. The SCO7554 genes in S. coelicolor and S. lividans differ by only two codon changes, neither of which alters the amino acid sequence; hence, our result suggests a role in protein synthesis for SCO7554. Codon usage by SCO7554 is, therefore, critical for its biological function on antibiotic pigment production.

**Min Keun Kim, Tae Ho Kang, Sung Kyum Kim, Yu Seok Jeong, Han Dae Yun, Hoon Kim. Disruption of rsmA gene of Pectobacterium carotovorum subsp. carotovorum LY34 and effect on pathogenicity. J. Korean Soc. Appl. Biol. Chem. 55(6):743-747**

The rsmA gene was cloned from soft-rot bacterium Pectobacterium carotovorum subsp. carotovorum LY34 (Pcc LY34), and its role in pathogenicity was investigated by marker exchange mutagenesis. From a cosmid library of Pcc LY34 genomic DNA, a positive clone carrying the rsmA gene was selected, and the gene was cloned by polymerase chain reaction (PCR) amplification. The gene is 186 bp in size and encodes a protein of 62 amino acids with a predicted molecular mass of 6,839 Da. The calculated pI of the RsmA is 8.16. The phylogenetic tree showed that the RsmA of Pcc LY34 appeared genetically identical to the CsrA of Pectobacterium atrosepticum SCRI1043 (100% identity) and similar to the CsrA of Yersinia pestis KIM10+ (98.3%). The gene was disrupted by the Kmr gene, and the cells became mutated (i.e., RsmA− mutant). The pathogenicity test revealed that the disease rating of the RsmA− mutant only differed slightly from that of the wild type on a slice of potato tuber and a Chinese cabbage stalk. These results suggest that RsmA is not an essential factor for the pathogenicity of Pcc LY34 and that the rsmA gene of Pcc LY34 is not completely derepressed in the RsmA− mutant for virulence-related genes, contrary to the results of Erwinia carotovora subsp. carotovora RsmA− mutant, which proved hypervirulent for celery petioles. These results showed that the microenvironmental conditions of the host and/or strain of pathogen are important for the coordination of virulence gene expression.

**Man-Ho Cho, Hye Lin Park, Jong-Hwa Park, Sang-Won Lee, Seong Hee Bhoo, Tae-Ryong Hahn. Characterization of regiospecific flavonoid 3′/5′-O-methyltransferase from tomato and its application in flavonoid biotransformation. J. Korean Soc. Appl. Biol. Chem. 55(6):749-755**

Flavonoids are ubiquitous secondary metabolites in plants and possess a wide range of biological activities such as anti-oxidant, anti-microbial, and anti-cancer activities. As a food ingredient, flavonoids are also thought to have health-promoting and disease-preventing properties. Structural modifications of flavonoids can improve their biological activities. Methylation is a common flavonoid modification that is catalyzed by O-methyltransferases (OMTs). We isolated four putative OMTs from the miniature tomato cultivar Micro-Tom. One OMT (SlOMT3) was successfully expressed in E. coli and purified. Recombinant SlOMT3 was found to be a regiospecific flavonoid 3′/5′-O-methyltransferase. Biochemical parameters show that SlOMT3 has higher binding affinity and catalytic efficiency for quercetin and luteolin than for eriodictyol. This suggests that flavonols and flavones are preferable substrates for SlOMT3. Biotransformation is considered a promising method to modify flavonoid structures. Transgenic E. coli expressing SlOMT3 was used to modify flavonoid substrates and was found to efficiently convert quercetin, luteolin, and eriodictyol to isorhamnetin, chrysoeriol and homoeriodictyol, respectively.

**Yunyoung Kwak, Sang-Jun Kim, In-Koo Rhee, Jae-Ho Shin. Application of quantitative real-time polymerase chain reaction on the assessment of organophosphorus compound degradation in in situ soil. J. Korean Soc. Appl. Biol. Chem. 55(6):757-763**

Quantitative real-time PCR (qPCR) method was applied to quantify the functional gene encoding organophosphorus hydrolase for assessing the degradation efficacy by bacterial strains on an organophosphorus compound in in situ soil. The specific primers targeting the organophosphorus hydrolase were designed and tested on reference bacterial strains and in DNA samples extracted from in situ soil samples contaminated by an organophosphorus compound. The established qPCR assay is a practical method for the analysis of in situ soil samples undergoing bioremediation of organophosphorus compounds.

**Lina Hem, A. M. Abd El-Aty, Jong-Hyouk Park, Jae-Han Shim. Determination of dinotefuran in pepper using liquid chromatography: Contribution to safety evaluation. J. Korean Soc. Appl. Biol. Chem. 55(6):765-768**

This paper presents a simple and sensitive method for detection and quantification of neonicotinoids (dinotefurans) in pepper. Extraction of pesticide was carried out with acetonitrile and water partition, and passed through cleanup. The residue levels were determined by high performance liquid chromatography with UV detection and liquid chromatography-tandem mass spectrometry (LC-MS/MS) confirmation. The analytical method was very good within a wide range of concentrations with linearity (r 2) of 1.00. The recovery at two fortification levels ranged between 91.2 to 97.5% with relative standard deviation less than 6.0%. The method was successfully applied for determination of the analyte in pepper grown under greenhouse conditions.

**Zaw Win Min, Su-Myeong Hong, In-Cheol Yang, Hye-Young Kwon, Taek-Kyum Kim, Doo-Ho Kim. Analysis of Pesticide residues in brown rice using modified QuEChERS multiresidue method combined with electrospray ionization-liquid chromatography-tandem mass spectrometric detection. J. Korean Soc. Appl. Biol. Chem. 55(6):769-775**

An efficient and modified Quick Easy Cheap Effective Rugged and Safe (QuEChERS) method combined with liquid chromatography-electrospray ionization with tandem mass spectrometric detection were evaluated for the analysis of residues of 72 pesticides in brown rice including acidic sulfonylurea herbicides. For extraction of pesticides and clean-up of the extract, 1% formic acid in acetonitrile and dispersive solid phase extraction were used, respectively. Two fortified spikes at 50 and 200 μg L−1 levels were performed for recovery test. Mean recoveries of majority of pesticides at two spike levels ranged from 90 to 110% with standard error (Coefficient of Variation) less than 10%. The limits of detection and quantification ranged from 0.24 to 19.92 μg L−1 and 0.79 to 65.74 μg L−1, respectively. Good linearity of calibration curves were achieved with R2>0.9943 within the observed concentration range (from 20 to 400 μg L−1). The modified method also provided satisfactory results for sulfonylurea herbicides, which could not be determined properly with previously reported methods. This method was applied to determine residues of target pesticides in real samples. A total of 22 pesticides in 31 out of 40 tested samples were observed. The highest concentration was observed for tricyclazole at 1.17 mg L−1. This pesticide found in two brown rice samples exceeded its MRL regulated for rice in Republic of Korea. Except this pesticide, concentrations of all observed pesticides were lower than their MRLs. The results reveal that the method is applicable for routine analysis of residues of target pesticides in brown rice.

**Min-Ju Kim, Keun-Sung Kim. Isolation and Identification of γ-Aminobutyric acid (GABA)-producing lactic acid bacteria from Kimchi. J. Korean Soc. Appl. Biol. Chem. 55(6):777-785**

Presumptive lactic acid bacteria (LAB) were isolated from 20 kimchi samples (total of 230 isolates) and screened for their capacity to synthesize γ-aminobutyric acid (GABA). Only 68 isolates (ca. 30%) showed this activity and were identified by a polyphasic approach consisting of morphological characteristics, catalase and biochemical tests, and species-specific polymerase chain reaction and 16S rRNA gene sequence analyses. Five species were found, including Lactobacillus plantarum (55 isolates), Lactobacillus brevis (six), Leuconostoc mesenteroides (four), Leuconostoc lactis (one), and Weissella viridescens (two). The 68 GABA-producing LAB isolates were isolated from only 11 among 20 kimchi samples indicating that they were not evenly distributed. This is the first report on the isolation of two species of Leuconostoc (Le. mesenteroides and Le. lactis) and one species of Weissella (Ws. viridescens) from kimchi with the capacity to synthesize GABA under in vitro conditions. Additionally, in previous screening results, Le. lactis and Ws. viridescens with the capacity to synthesize GABA isolated and identified from fermented food source were not observed.

**Baolo Kim, Weon Taek Seo, Min Geun Kim, Han Dae Yun, Kye Man Cho. Metagenomic lactic acid bacterial diversity during Mulkimchi fermentation based on 16S rRNA sequence. J. Korean Soc. Appl. Biol. Chem. 55(6):787-792**

Lactic acid bacterial diversity and the composition of individual bacterial communities during the fermentation of mulkimchi were examined using a polymerase chain recation (PCR)-based approach. Based on 16S rRNA sequence similarity values, a total of fifteen different lactic acid bacterial species were found in eight sampling sites, including Lactobacillus alimentarius, Lactobacillus brevis, Lactobacillus farciminis, Lactobacillus fabifermentans, Lactobacillus nantensis, Lactobacillus parabrevis, Lactobacillus plantarum, Lactobacillus versnoldensis, Lactobacillus zymae, and Lactobacillus sp., Leuconostoc pseudomesenteroides, Weissella cibaria, Weissella confusa, and Weissella sp. The prevalence of We. cibaria, belonging to the Weissella genus, was the highest (86.7%) at 0 h (initial stages) and gradually decreased at 72 h (rancid stage). In contrast, La. plantarum was observed at 36 h (16.7%, over-ripening stage) and gradually increased up to 84 h (70.0%, rancid stage) during mulkimchi fermentation. We. cibaria was found to be associated with the microorganisms that were present during the initial stage of fermentation, whereas La. plantarum was associated with the production of lactic acid in the over-ripening and rancid stages during fermentation at 30°C±2.

**Yu Jin Ahn, Palanivel Ganesan, Hae-Soo Kwak. Comparison of polyphenol content and antiradical scavenging activity in methanolic extract of nanopowdered and powdered peanut sprouts. J. Korean Soc. Appl. Biol. Chem. 55(6):793-798**

Polyphenol contents and antiradical scavenging activities of nanopowdered peanut sprout (NPPS) and powdered peanut sprout (PPS) were compared using various antiradical scavenging assays such as α-diphenyl-β-picryl-hydrazyl free radical (DPPH·) scavenging, 2, 2-azino-bis(3-ethylbenzthiazoline-6-sulfonic acid) radical scavenging activity, reducing power, and superoxide dismutase. The size of NPPS ranged from 300–350 nm as observed by the particle size analyzer, much smaller than that of PPS ranging from 50 to 150 μm. Total polyphenol contents in NPPS (455.05±18.69 μg/mL) were relatively higher than those of PPS (421.99±14.94 mg/mL). NPPS showed higher antioxidant activity than PPS at all concentrations (2.5, 5, 10, 15 and 20 mg/mL). Overall, the antiradical scavenging activity was much higher in NPPS and nanogrinding increases the surface area of polyphenol with higher functional site.

**Yao Qin, Heui-Dong Park. Overexpressed acetohydroxyacid reductoisomerase (ILV5) gene in Saccharomyces cerevisiae reduces diacetyl contents in Korean Campbell Early and Muscat Bailey a grape wines. J. Korean Soc. Appl. Biol. Chem. 55(6):799-801**

An ILV5 (acetohydroxyacid reductoisomerase) gene expression vector (designated pILV5) was constructed by cloning the yeast ILV5 gene into a yeast expression vector (pLG669Z) containing yeast CYC1 promoter. S. cerevisiae cells harboring the pILV5 plasmid showed ∼3.7-fold higher level of the diacetyl reductase activity compared with the control yeast cells. When they were applied to wine fermentation using Campbell Early and Muscat Baily A grapes, the diacetyl content level was reduced to ∼35.0–39.0% of those obtained with the control yeasts.

**Euteum Park, Do Kyung Kim, Hong Sung Chun. Resveratrol inhibits lipopolysaccharide-induced phagocytotic activity in BV2 cells. J. Korean Soc. Appl. Biol. Chem. 55(6):803-807**

The inhibitory effects of resveratrol, a natural bioactive polyphenolic phytoalexin rich in grape, on lipopolysaccharide (LPS)-induced microglial activation and its beneficial effects on dopaminergic neurodegeneration were studied. Resveratrol dosedependently suppressed LPS-induced nitric oxide production and the expression of inducible NO synthase (iNOS) in BV-2 microglial cells. Furthermore, resveratrol (1 μM) significantly blocked BV2 microglial phagocytosis induced by LPS (0.1 μg/mL). Although the conditioned media from LPS-stimulated BV2 cells caused the SN4741 dopaminergic neuronal cell death, that from resveratrolpretreated BV2 cells did not diminish the viability of SN4741 cells. These results suggest that resveratrol can prevent neuronal death possibly through the modulation of phagocytosis and microglial activation.

**Ji-Yeon Yang, Min-Gi Kim, Hoi-Seon Lee. Phototactic behavior: Attractive effects of Spodoptera litura (Lepidoptera: Noctuidae), tobacco cutworm, to high-power light-emitting diodes. J. Korean Soc. Appl. Biol. Chem. 55(6):809-811**

Phototactic responses of Spodoptera litura adults to high-power light-emitting diodes (HPLEDs) were investigated at four different wavelengths, various light intensities, and light-exposure times under laboratory conditions. All light sources were significantly attractive to S. litura adults at 40 lx light intensity and 60 min light-exposure time; thus they were established as the optimal conditions. When the attraction rate of S. litura adults was surveyed at the optimal conditions, the green HPLED (520±5 nm) exhibited the highest potential attraction rate (64.3%), followed by the blue HPLED (470±10 nm, 47.7%), the yellow HPLED (590±5 nm, 33.3%), and the red HPLED (625±10 nm). Compared to fluorescent light, which was used as a positive control (380–800 nm, 50.0%), the green HPLED was approximately 1.3 times more effective at attracting S. litura adults. In conclusion, use of the green HPLED (520±5 nm) was the most suitable for attraction of S. litura adults under optimal conditions.

**Natcha Wongsrikaew, Hyeonji Kim, Kanit Vichitphan, Somi Kim Cho, Jaehong Han. Antiproliferative activity and polymethoxyflavone composition analysis of Kaempferia parviflora extracts. J. Korean Soc. Appl. Biol. Chem. 55(6):813-817**

To investigate anticancer effects of Kaempferia parviflora, rhizomes of K. parviflora were extracted with supercritical CO2 fluid and ethanol under various extraction conditions. Antiproliferative activity of these extracts was evaluated against human cervical cancer HeLa and human gastric adenocarcinoma AGS cell lines. Supercritical CO2 fluid extracts (SFEs) of K. parviflora showed more potent antiproliferative activity than the ethanol extracts against both cell lines, because SFEs contained higher concentration of polymethoxyflavones (PMFs) (72–89 wt%) than the ethanol extract (55–70 wt%). From the compositional analysis of the extracts, 5,7-dimethoxyflavone (**1**) in K. parviflora was proposed as a potent anticancer PMF. Furthermore, it was found that PMFs with more methoxy groups do not necessarily show better anticancer activity.

**Nam Iee Oh, Yeon-Ki Kim, Baek Hie Nahm, Jong-Joo Cheong. Quadruple 9-mer-based protein binding microarray analysis of the arabidopsis transcription factor AtMYB77. J. Korean Soc. Appl. Biol. Chem. 55(6):819-822**

Binding sequence specificity of the Arabidopsis transcription factor AtMYB77 was determined by the quadruple 9-mer-based protein binding microarray (Q9-PBM) analysis. The position weight matrix and Wilcoxon-Mann-Whitney test with total 1843 clustered signals revealed that the full size AtMYB77 protein binds specifically to the consensus sequence pAACnG, where p represents T or C; n, A, G, C or T. This sequence is known as the type I binding site for MYB transcription factors. This result indicates that functional diversity among the type I MYB transcription factors is not due to their binding specificity on a particular promoter sequence.

**Pamella Marie Sendon, Jong-Beum Park, Hak Soo Seo, Soon-Ki Park, Jong Tae Song. Temporal and spatial expression patterns of the gene AtBSMT1 encoding a salicylic acid methyltransferase in arabidopsis transgenic plants. J. Korean Soc. Appl. Biol. Chem. 55(6):823-826**

Expression patterns of AtBSMT1 encoding an S-adenosyl-L-methionine: salicylic acid carboxyl methyltransferase from Arabidopsis thaliana were analyzed in AtBSMT1 promoter::β-glucuronidase (GUS) transgenic Arabidopsis. AtBSMT1 was expressed in flowers and siliques and induced under specific biotic/abiotic stress conditions. The results indicated that the induction of AtBSMT1 is regulated by plant disease response and jasmonic acid signaling.

**Eunhye Kim, Hyeri Lee, Soonsung Hong, Kyung-Hun Park, Xuehua An, Jeong-Han Kim. Comparative exposure of operators to fenthion during treatment in paddy field. J. Korean Soc. Appl. Biol. Chem. 55(6):827-830**

Operator exposure was evaluated to find out any possible risk during fenthion application in paddy. Hand exposure during mixing/loading was 0.04–33.06 mg, whereas those for spraying were 20.3–288.3 mg. Highest exposure was observed on legs (54%) followed by hand (28%). Inhalation exposure accounted for only 0.001–0.2% of dermal exposure. High variations of exposure levels were observed between repetitions and operators, indicating that lager number of repetitions are strictly required to establish comprehensive exposure database and predicting models. Margin of safety indicated that application works were safe when extreme cases were not considered.

**Kodithuwakku Kankanange Indika Upali Arunakumara, Buddhi Charana Walpola, Min-Ho Yoon. Aluminum toxicity and tolerance mechanism in cereals and legumes — A review. J. Korean Soc. Appl. Biol. Chem. 56(1):1-9**

Aluminum (Al), the third most abundant element overall, after silicon and oxygen, is found virtually in all food, air, soil and water. Under acidic conditions, Al is solubilized into [Al(H2O)6]3+, which is highly toxic to many plant species. Present paper reviewed Al toxicity and tolerance mechanism in agricultural plants with special reference to cereals and legumes. Even at micromolar concentrations, cell division in the root tip meristem in sensitive plants is quickly inhibited by Al3+. Expressing the species-dependent manner of response, growth enhancement at low concentrations of Al3+ is also reported from some plants such as soybean. Plasma membrane can be identified as the primary target of Al toxicity, where production of higher reactive oxygen species and higher fatty acid peroxidation has been observed due to alteration of plasma membrane integrity. Though, toxicity and the mechanisms attributed to Al-resistance are extremely complex phenomena, exclusion is widely accepted as the key mechanism involved in detoxifying Al3+. Exudation of chelating ligands, formation of pH barrier at the rhizosphere or at root apoplasm, cell wall immobilization, selective permeability of the plasma membrane, and Al efflux have been proposed as the possible mechanisms for Al exclusion. Al-induced exudation in cereals and legumes is dominated by citrate, malate, and oxalate in varying degrees depending on the species and/or cultivar. Apart from sensitive cultivars, moderately tolerant or tolerant cultivars can also be distinguished from various kinds of cereals and legumes. However, reliable techniques for screening such resistant genotypes have not been developed for any economically important crops.

**Yen San Chan, Mashitah Mat Don. Optimization of process variables for the synthesis of silver nanoparticles by *Pycnoporus sanguineus* using statistical experimental design. J. Korean Soc. Appl. Biol. Chem. 56(1):11-20**

Sequential optimization strategy based on statistical experimental design and one-factor-at-a-time (OFAT) method were employed to optimize the process parameters for the enhancement of silver nanoparticles (AgNPs) production through biological synthesis using *Pycnoporus sanguineus*. Based on the OFAT method, three significant components influencing the size of AgNPs produced were identified as AgNO3 concentration, incubation temperature, and agitation speed. The optimum values of these process parameter for the synthesis of AgNPs were determined using response surface methodology (RSM) based on Box-Behnken design. The validity of the model developed was verified, and the statistical analysis showed that the optimum operating conditions were 0.001 M of AgNO3, 38°C, and 200 rpm with the smallest AgNPs produced at 14.86 nm. The disc diffusion method also suggested that AgNPs produced using optimum conditions have higher antimicrobial activity compared to the unoptimized AgNPs. The present study developed a robust operating condition for the production of AgNPs by *P. sanguineus*, which was 8.6-fold smaller than that obtained from un-optimized conditions.

**Hyon Jin Park, Yang Do Choi, Sang Ik Song, Hawk-Bin Kwon, Nam Iee Oh, Jong-Joo Cheong. Overexpression of the 3′(2′),5′-bisphosphate nucleotidase gene *AtAHL* confers enhanced resistance to *Pectobacterium carotovorum* in *Arabidopsis.* J. Korean Soc. Appl. Biol. Chem. 56(1):21-26**

The Arabidopsis AtAHL gene encodes a 3′(2′),5′-bisphosphate nucleotidase that catalyzes the conversion of adenosine 3′,5′-bisphosphate (PAP) into adenosine monophosphate and inorganic phosphate. We have generated transgenic Arabidopsis overexpressing this gene under control of the cauliflower mosaic virus 35S (CaMV 35S) promoter. Transgenic lines integrating a single copy of the insert DNA and constitutively expressing the AtAHL gene were selected. The transgenic lines of Arabidopsis plants exhibited enhanced resistance to Pectobacterium carotovorum subsp. carotovorum. In general, plant defense responses and sulfur metabolism are linked through jasmonic acid signaling. The expression of sulfur-related defense genes is known to be induced via a jasmonate-mediated signaling pathway. In this work, we observed that the expression of AtAHL was also induced by jasmonate treatment in Arabidopsis. Our data suggest that PAP catabolic activity enhanced by the jasmonate signaling pathway contributes to the rapid flux of the sulfur activation pathway, accelerates the incorporation of activated sulfur into sulfur-containing defense molecules such as defensins, thionins, and glucosinolates, and thereby increases defense resistance in plants.

**Yeon Jong Koo, Eun Sil Yoon, Jun Sung Seo, Ju-Kon Kim, Yang Do Choi. Characterization of a methyl jasmonate specific esterase in arabidopsis. J. Korean Soc. Appl. Biol. Chem. 56(1):27-33**

Methyl jasmonate (MeJA)-specific methyl esterase of Arabidopsis (AtMJE) was identified and characterized. AtMJE has high substrate specificity to MeJA compared to other related substrates, methyl indole-3-acetate (MeIAA) and methyl salicylate (MeSA). Through enzyme kinetics analysis, we found AtMJE has similar level of substrate affinity to JA carboxyl methyltransferase (AtJMT). However, AtMJE has 10 times lower catalytic efficiency than AtJMT at low substrate concentrations. AtMJE gene expression was suppressed for 2 h after MeJA treatment, even though its expression recovered and was induced to maximum level within 8 h after treatment. AtMJE overexpressing plants (AtMJEox) showed enhanced MeJA methyl esterase activity demonstrating esterase activity of AtMJE in vivo. AtMJEox plants responded differentially to JA and MeJA in root growth. MeJA in the media could be a source for more JA production in AtMJEox plants, which resulted in root growth inhibition. In contrast, AtMJEox plants grown on JA containing media showed similar root growth inhibition as wild-type. These results show that AtMJE functions in altering JA/MeJA ratios in Arabidopsis and increased JA, because the conversion of MeJA to JA enhances JA responsive gene expression.

**Moonhyuk Kwon, Bok-Kyu Shin, Jaekyoung Lee, Jaehong Han, Soo-Un Kim. Characterization of *Burkholderia glumae* BGR1 4-hydroxy-3-methylbut-2-enyl diphosphate reductase (HDR), the terminal enzyme in 2-*C*-methyl-d-erythritol 4-phosphate (MEP) pathway. J. Korean Soc. Appl. Biol. Chem. 56(1):35-40**

4-Hydroxy-3-methylbut-2-enyl diphosphate reductase (HDR) is the ultimate enzyme in 2-C-methyl-D-erythritol 4-phosphate (MEP) pathway converting (E)-4-hydroxy-3-methylbut-2-enyl pyrophosphate (HMBPP) into isopentenyl diphosphate (IPP) and dimethylallyl diphosphate (DMAPP). Burkholderia glumae, a Gram-negative rice-pathogenic bacterium, harbors 2 hdr genes and lacks isopentenyl diphosphate isomerase (idi). Both HDR enzymes could complement E. coli hdr deletion mutant (DYTL1). Both of the recombinant HDR proteins, BgHDR1 and BgHDR2, catalyzed reduction of HMBPP into IPP and DMAPP at a ratio of 2:1, in contrast to 5:1 ratio of other bacterial HDRs so far characterized. The kcat and Km values of BgHDR1 and BgHDR2 were 187.0 min−1 and 6.0 μM and 66.6 min−1 and 21.2 μM, respectively. Physiological significance of the kinetic properties was discussed.

**Yeong-Bae Yun, Seong-Wan Park, Jae-Soon Cha, Young-Kee Kim. Biological characterization of various strains of *Pseudomonas tolaasii* that causes brown blotch disease. J. Korean Soc. Appl. Biol. Chem. 56(1):41-45**

Brown blotch disease of cultivated mushrooms is caused by Pseudomonas tolaasii, which secretes the bacterial toxin, tolaasin. Tolaasin is a peptide toxin that causes pore formation in the plasma membrane of mushroom cells. Forty-two strains of pathogenic bacteria causing brown blotch or similar diseases were isolated from mushrooms showing disease symptoms. To characterize these bacteria, the genes of 16S rRNA were sequenced and analyzed. Thirty-three strains were identified as five different species of Pseudomonas. Of these, 23 were identified as P. tolaasii and named as P1-type pathogens. Because the strains identified as P. tolaasii were major pathogens that cause the brown blotch disease, phylogenetic analyses of these pathogens were conducted by the neighbor-joining method. These strains comprised three phylogenetic subtypes, P1α (6 strains), P1β (16 strains), and P1γ (1 strain). Biological characterizations of the isolated bacteria were performed and confirmed that all three subtypes were able to cause the disease by forming blotches on the surface of the mushroom tissue. However, hemolytic activities were observed in the P1α and P1γ strains, but not in the P1β strains. These results imply that remarkable diversity exists among the various strains of P. tolaasii, each strain showing distinct biological characters.

**Jong-Hwan Kim, Jong-Su Seo, Joon-Kwan Moon, Jeong-Han Kim. Multi-residue method development of 8 benzoylurea insecticides in mandarin and apple using high performance liquid chromatography and liquid chromatography-tandem mass spectrometry. J. Korean Soc. Appl. Biol. Chem. 56(1):47-54**

Multi-residue method of eight benzoylurea insecticdes (8BUs; diflubenzuron, triflumuron, hexaflumuron, teflubenzuron, novaluron, lufenuron, flufenoxuron, and chlorfluazuron) in apple and mandarin were developed with high performance liquid chromatography and liquid chromatography-tandem Mass spectrometry. Using multiresidue standard solutions, extraction, partition, and clean-up procedures have been established. Extraction with acetone and partition with n-hexane gave reasonable recovery of more than 90%. Clean-up with florisil-glass column using acetone/n-hexane as eluting solvents resulted in good efficiency of higher than 94%. By employing the established analytical method, recovery test of 8BUs in mandarin and apple was conducted to give recovery of 80–110%, which satisfies the Korea Food & Drug Administration criteria. The method limit of quantitation (MLOQ, 0.02 mg/kg) was lower than 1/2 of maximum residue limits of crops. Excellent sensitivity and selectivity were obtained with liquid chromatography tandem mass spectrometry (LC-MS/MS)-Electrospray ionization(-) even in the samples with no clean-up, suggesting LC-MS/MS can be used for the fast multi-residue method of 8 benzoylurea insecticides in mandarin and apple.

**Young-Ok Kim, In-Suk Park, Hyung-Kwoun Kim, Bo-Hye Nam, Hee Jeong Kong, Woo-Jin Kim, Dong-Gyun Kim, Bong-Seok Kim, Young-Ju Jee, Jung-Hun Song, Sang-Jun Lee. *Shewanella* sp. Ke75 esterase with specificity for *p*-nitorphenyl butyrate: Gene cloning and characterization. J. Korean Soc. Appl. Biol. Chem. 56(1):55-62**

A bacterial strain that produces a cold-adapted esterase was isolated from tidal flats and identified as Shewanella sp. Ke75. In the present study, the corresponding gene was cloned using the shotgun method. The amino acid sequence deduced from the nucleotide sequence (957 bp) corresponded to a protein of 318 amino acid residues with a calculated molecular weight of 34875 Da. The esterase showed 68 and 57% identities with the putative esterases of Shewanella amazonensis SB2B and Colwellia psychrerythraea 34H, respectively. The esterase contained a putative leader sequence, as well as the conserved catalytic triad (Ser, His, Asp), consensus pentapeptide GXSXG, and oxyanion hole sequence (HG). The protein Ke75 was produced in both soluble and insoluble forms when Escherichia coli cells harboring the gene were cultured at 30°C. The enzyme showed specificity for C4 (butyrate) as a substrate, with little activity toward the other p-nitrophenyl esters tested. The optimum pH and temperature for enzyme activity were pH 9.0 and 30°C, respectively. Relative activity remained up to 60% even at 5°C with an activation energy of 6.29 kcal/mol, which indicated that it was a cold-adapted enzyme. Enzyme activity was enhanced in the presence of Mn2+ ions, but inhibited by Cd2+, Cu2+, Hg2+, and Zn2+ ions.

**Chang-Geun Song, Moo-Yeol Baik, Byung-Yong Kim. Rheological properties of native maize, waxy maize, and acetylated maize starches, and applications in the development of food products. J. Korean Soc. Appl. Biol. Chem. 56(1):63-68**

Feasibility of using native and modified maize starches in various food systems such as surimi, soup and noodle was investigated. The viscosity of native maize starch (NMS) increased dramatically with an increase in the starch concentration and a decrease in the temperature, whereas that of of waxy maize starch (WMS) showed no significant change. The acetylated maize starch (AMS) had a lower gelatinization temperature and enthalpy than NMS and WMS. NMS had the highest storage modulus (G′) and loss modulus (G″), whereas WMS had the lowest G′ and G″. The G′ values of all of the surimi increased from 55°C, and the G′ of surimi paste with NMS added was greater than that of the surimi mixed with WMS and AMS. The viscosity of soup containing WMS showed a lower increase than with NMS and AMS. Noodles mixed with AMS had the shortest cooking time, indicating that each starch had typical characteristics that could be applied to food manufacturing.

**Jin-Woong Jeong, Kee-Jae Park, Jeong-Ho Lim, Jung-Min Sung. Analysis of hazard on fresh and salted *baechus* (nappa cabbage, *Brassica rapa L. subsp. pekinensis*) in Korea. J. Korean Soc. Appl. Biol. Chem. 56(1):69-76**

Risk factors, such as microorganism, parasite eggs, pesticide residues, and heavy metal in fresh and salted baechus (napa cabbage, Brassica rapa L. subsp. pekinensis) were analyzed once a month from April 2010 to March 2011. Total bacterial population of salted baechu in summer (2.08–5.11 log CFU/g) was higher than that in winter. Also, coliform population in salted baechu during winter decreased by 2 log CFU/g as compared with that in summer. Pesticide residues and parasite eggs were not detected in any salted baechu. Pb was detected at 0.06 ppm in the winter salted baechu, but the lever was lower than the residue tolerance of the Korea food code. The pH of salted baechu during a 1-year period showed the lowest level at 4.76–5.22 in August and then gradually increased. The microbe results showed a high correlation with the pH of the salted baechu.

**Soon-Mi Shim, Seung-Yong Lim. Texture properties and radical scavenging ability of porridge products based on beans, grains, and nuts. J. Korean Soc. Appl. Biol. Chem. 56(1):77-82**

Textural and sensory properties and radical scavenging ability of rice and cereal-based porridges such as beans, nuts, and grains were examined. Textural properties of the porridges, including hardness, adhesiveness, cohesiveness, springiness, and gumminess, were determined using a TA-XT2 texture analyzer. For the sensory evaluation, thirty-five volunteers participated in the randomized incomplete block design. The 1-diphenyl-2-picrylhydrazyl method was carried out to determine the radical scavenging ability of the porridges. Cereal-based porridges added with beans, grains, and nuts appeared to be less hard and sticky than plain rice porridges. Overall sensory acceptabilities for black rice, walnut, and pine-nut porridges were higher than those for plain rice porridges. Pine-nut, walnut, grain porridge such as wild sesame, black rice, and mixed grains provide strong radical-scavenging ability compared to plain rice porridges. Our results suggest that cereal-based porridge prepared with beans, grains, and nuts are nutritious and palatable substitute food for people with chewing difficulty.

**Jae-ho Choi, Cher-won Hwang, Hyung-ki Do, Gi-seok Kwon, Sun-chul Kang. Anti-oxidizing functional effect of polyamine as a bioconversion starter using microbes isolated from fluke babsikhae. J. Korean Soc. Appl. Biol. Chem. 56(1):83-86**

Polyamines are well known as important molecular compounds for many biochemical processes in animals and plants. The function of biogenic polyamine has been especially well studied for its role in the oxidative system and the protection of membranes from peroxidation in cells. We investigated the polyamine contents of fluke babsikhae and isolated polyamineproducing lactic acid bacteria (LAB) to improve the probiotic antioxidative function of the Korean traditional fermented food, fluke babsikhae. In the present study, first we confirmed that fluke babsikhae possesses more antioxidative molecules compared to the other antioxidative vegetable (Korean radish) and ascorbic acid by using the method of peroxide value (POV). Secondly polyamines, which are considered as antioxidative molecules, were detected in fluke babsikhae using thin layer chromatography (TLC) and high performance liquid chromatography (HPLC). In order to improve the probiotic function of fluke babsikhae, LABs were isolated from the fermented food, and these isolated microbes were tentatively identified as Lactobacillus brevis strain bh3 and Lactobacillus sp. using 16S rRNA sequencing. Polyamine was produced from these two strains and also was confirmed to have antioxidative activity. Especially Lactobacillus sp. was shown to produce high amounts of putrescine. Therefore, this strain can be considered as a starter to improve the probiotic function of fluke babsikhae. According to the results, fluke babsikhae will be a good candidate for a healthy functional food and also isolated LAB will be considered as a starter for probiotics by bioconversion.

**Hoon Choi, Joon-Kwan Moon, Jong-Su Seo, Jeong-Han Kim. Establishment of retention index library on gas chromatography-mass spectrometry for nontargeted metabolite profiling approach. J. Korean Soc. Appl. Biol. Chem. 56(1):87-90**

The retention indices of metabolites expected to be in rice have been established with gas chromatography-mass spectrometry (GC-MS) after derivatization. Total 187 metabolites (59 lipids and 128 polar metabolites) including fatty acids, hydrocarbons, alcohols, steroids, sugars, sugar alcohols, organic acids, amino acids, amines, and amides were analyzed using GCMS and their retention indices were calculated. These retention indices are expected to be used for the identification of various metabolites in many types of crops.

**Ji-Yeon Yang, Kyoung-Shik Cho, Nam-Hyun Chung, Chung-Ho Kim, Joo-Won Suh, Hoi-Seon Lee. Constituents of volatile compounds derived from *Melaleuca alternifolia* leaf oil and acaricidal toxicities against house dust mites. J. Korean Soc. Appl. Biol. Chem. 56(1):91-94**

The acaricidal activities of the volatile compounds derived from Melaleuca alternifolia leaf oil were evaluated against house dust mites. Terpinen-4-ol (3.89 and 3.51 μg/cm2) was approximately 2.0 and 1.7 times more active than benzyl benzoate (7.83 and 5.96 μg/cm2). Therefore, terpinen-4-ol could be useful as a natural acaricide.

**Inkyu Hwang, Daewoon Choi, Hyejeong See, Wonyong Kim, In Sik Chung, Dong-Hwa Shon. Beneficial effects of the mixed adjuvant of CpG plus monophosphoryl lipid a in immunization with a recombinant protein vaccine for hepatitis A. J. Korean Soc. Appl. Biol. Chem. 56(1):95-98**

In an effort to develop a new vaccine for hepatitis A, which is mainly transmitted via contaminated foods and water, recombinant virus protein 1 (VP1) of hepatitis A virus was used as an antigen. Several adjuvants in a single or a mixed form, i.e., alum, CpG oligodeoxynucleotide, monophosphoryl lipid A (MPL), alum plus MPL, and CpG plus MPL, were also tested for their immunological properties. When their effects on the production of VP1-specific IgG relative to that of total IgG and the levels of and balance between Th1- and Th2-type cytokine productions were compared, CpG plus MPL was found to have highly beneficial effects, providing a new insight in selection of adjuvant for development of a new vaccine.

**Lingzhu Meng, Seung Hwan Yang, Tae-Jong Kim, Joo-Won Suh. Two base mutations of a putative LacI-family transcriptional regulator, *SCO7554*, reverse the overexpression effect on the antibiotic pigment production in *Streptomyces coelicolor.* J. Korean Soc. Appl. Biol. Chem. 56(1):99-101**

The SCO7554 protein, a putative LacI-family transcriptional regulator, is important in the antibiotic pigment production in Streptomyces coelicolor M130. A single mutation at the 4th amino acid from asparagine to serine reversed the SCO7554 effect on the antibiotic pigment production in an overexpression experiment. Additional mutation at the 276th amino acid from valine to alanine intensified this effect, and the overexpression of the double mutant SCO7554 increased the production of antibiotics, whereas the overexpression of SCO7554 itself decreased the antibiotic productions. This observation suggested the functional importance of the N-terminal region of a putative LacI-family transcriptional regulator, SCO7554 protein, even though it was not located on any known functional domain.

**Joo-Mi Yoon, Bum-Soo Hahn, Tae-Lim Kim, Man-Ho Cho, Seong Hee Bhoo, Tae-Ryong Hahn, Sang-Won Lee. An efficient method for detection of recombinant proteins using a bacteriophytochrome chromophore binding domain from *Deinococcus Radiodurans.* J. Korean Soc. Appl. Biol. Chem. 56(1):103-106**

Bacteriophytochromes are composed of N-terminal region for chromophore binding and C-terminal domain for transmission of a light signal. In this study, the possibility of using the chromophore-binding domain from a Deinococcus radiodurans bacteriophytochrome as a protein tag to enable a rapid and simple detection method for the production of recombinant proteins were evaluated.

**Jinhua Cheng, Ying-Yu Jin, Seung Hwan Yang, Joo-Won Suh. Isolation and characterization of anti-methicillinresistant *Staphylococcus aureus*/vancomycinresistant *Enterococcus* compound from *Streptomyces bungoensis* MJM 2077. J. Korean Soc. Appl. Biol. Chem. 56(1):107-111**

Strain MJM2077 was selected for its strong anti-Methicillin-resistant Staphylococcus aureus/Vancomycin-resistant Enterococcus activity and designated as Streptomyces bungoensis MJM2077 based on the analysis of the 16S rDNA sequence. The active compound, which was very stable under acidic conditions, was purified and identified as echinomycin by NMR and mass spectrometry. This is the first report on the isolation of echinomycin from a S. bungoensis strain, and the development of high-producing strains is in progress.

**Soon Young Shin, Young Han Lee. 3-Hydroxyflavanone induces apoptosis in HeLa cells. J. Korean Soc. Appl. Biol. Chem. 56(1):113-116**

Flavonoids and their derivatives exhibit many biological properties, including anti-inflammatory and antitumor activities. However, the antitumor action of 3′-hydroxyflavanone (3′-HF) is largely unknown. Antitumor efficacy of 3′-HF was assessed using cervical cancer (HeLa) cells. 3′-HF treatment resulted in a reduction in cell proliferation. A flow cytometric analysis demonstrated that 3′-HF deregulated cell cycle progression and triggered apoptosis. 3′-HF also increased the levels of p53 and p21, but decreased the level of cyclin D1. 3′-HF-induced apoptosis was accompanied by poly(ADP-ribose)polymerase cleavage. Together, these data indicate that 3′-HF possesses antitumor activity, which is mediated via the deregulation of cell cycle progression and induction of apoptosis.

**Min-Kyung Lee, Hee-Jung Park, Sung-Ho Kwon, Ye-Jin Jung, Ha-Na Lyu, Do-Gyeong Lee, Na-Young Song, Hong-Keun Choi, Sangkyu Park, Nam-In Baek, Youn-Hyung Lee. Tellimoside, a flavonol glycoside from *Brasenia schreberi*, inhibits the growth of cyanobacterium (*Microcystis aeruginosa* LB 2385). J. Korean Soc. Appl. Biol. Chem. 56(1):117-121**

Principal components of aquatic plants responsible for inhibiting the growth of Microcystis aeruginosa, a blue-green alga (cyanobacterium) were determined. Methanol extracts of Brasenia schreberi showed strong inhibitory activity against the growth of the cyanobacterium. Two purified flavonoids were afforded through repeated column chromatographies. The compounds were determined as quercetin (**1**) and quercetin 3-O-(6″-galloyl)-β-d-glucopyranoside, tellimoside (**2**) by the interpretation of spectroscopic data including NMR, MS, and IR. Compounds **1** and **2** were first isolated from Brasenia schreberi. In addition, compound **2** showed very strong inhibitory activity against the growth of M. Aeruginosa.

**Dongfei Han, Ji-Young Ryu, Hyunji Lee, Hor-Gil Hur. Bacterial biotransformation of phenylpropanoid compounds for producing flavor and fragrance compounds. J. Korean Soc. Appl. Biol. Chem. 56(2):125-133**

Phenylpropanoids are common aromatic compounds synthesized by plants that are often used as starting compounds for the production of various flavor and fragrance compounds. The use of bacterial metabolism as a means to produce valueadded compounds from natural resources has been given much attention as an alternative method to replace conventional chemical syntheses. This review describes bacterial metabolisms of the phenylpropanoid compounds trans-anethole, isoeugenol, and isosafrole to better understand efficient production of natural fragrance and other value-added compounds.

**Mi-Young Baek, Hee-Jung Park, Gi-Min Kim, Dae-Young Lee, Gee-Young Lee, Sun-Ju Moon, Eun-Mi Ahn, Geum-Soog Kim, Myun-Ho Bang, Nam-In Baek. Insecticidal alkaloids from the seeds of *Macleaya cordata* on cotton aphid (*Aphis gossypii*). J. Korean Soc. Appl. Biol. Chem. 56(2):135-140**

Alcohol extracts from the seeds of Macleaya cordata have shown a significant insecticidal effect against the growth of the cotton aphid, Aphis gossypii Glover. In this study, we aimed to isolate the principal component of M. cordata to manifest its insecticidal effect on A. gossypii. The dried seeds of M. cordata were extracted with 80% aqueous methanol (MeOH), and the concentrated extracts were partitioned successively with ethyl acetate (EtOAc), n-butyl alcohol (n-BuOH), and H2O. During the search for an insecticidal compound against the aphids, activityguided fractionation led to the isolation of two alkaloids from an n-BuOH fraction through repeated silica gel column chromatographic separations. Based on NMR, MS, and IR spectroscopic data, the chemical structures of the compounds were determined to be 8-hydroxydihydrochelerythrine (**1**) and 8-methoxydihydrosanguinarine (**2**) This is the first study in which 8-methoxydihydrosanguinarine was isolated from M. cordata. 8-Hydroxydihydrochelerythrine (**1**) and 8-methoxydihydrosanguinarine (**2**) decreased the survival of the cotton aphid by 76.1±7.9 and 73.6±14.6% at 100 ppm, respectively.

**Dong Hun Lee, Jeong-Woo Kang, Yong-Seok Song, Jung-Hee Kim, Man Sub Kim, Yesol Bak, Deok-Kun Oh, Do-Young Yoon. Compound K attenuates lipid accumulation through down-regulation of peroxisome proliferator-activated receptor γ in 3T3-L1 cells. J. Korean Soc. Appl. Biol. Chem. 56(2):141-147**

Compound K (CK) is rare ginsenosides present at low concentrations or absent in ginseng roots. These rare ginsenosides can be produced from the major ginsenosides Rb1, Rb2, and Rd through hydrolysis of sugar moieties. Recently, CK has been found to have anti-diabetic effects through adenosine 5-phosphateactivated protein kinase (AMPK) activation in human hepatoma cells and a stimulatory effect of glucose uptake in 3T3-L1 adipocytes, as well as anti-obesity effect by down regulation of peroxisome proliferator-activated receptor γ (PPARγ) gene expression in 3T3-L1. However, detailed anti-obesity pathway by CK remains unclear. In the present study, the effects of CK produced from Sulfolobus acidocaldarius on PPARγ signaling during adipocyte differentiation in 3T3-L1 cell were examined. Treatment of differentiating 3T3-L1 cells with CK resulted in down-regulation of fatty acid synthase (FAS), a target gene of PPARγ. The modulating effect of CK on expression of genes involved in lipogenesis was abrogated in part by treatment with troglitazone, a PPARγ agonist. CK significantly decreased accumulation of lipid droplets and PPARγ expression induced by troglitazone in 3T3-L1 adipocytes, suggesting that CK downregulates PPARγ expression and its transcriptional activity as well as abrogates PPARγ signaling pathway induced by troglitazone, a PPARγ agonist. These results indicate that CK inhibits 3T3-L1 adipogenic differentiation by inhibiting PPARγ and FAS expressions as well as interferes with PPARγ signaling pathway induced by PPARγ agonist, and may act as an anti-adipogenic ginsenoside for regulating body fat through its effects on differentiation.

**Nayeon Ryoo, Joon-Seob Eom, Hyun-Bi Kim, Bich Thuy Vo, Sang-Won Lee, Tae-Ryong Hahn, Jong-Seong Jeon. Expression and functional analysis of rice plastidic maltose transporter, *OsMEX1.* J. Korean Soc. Appl. Biol. Chem. 56(2):149-155**

In Arabidopsis, maltose is a major product of the transitory starch degradation pathway at night, and its mobilization from the chloroplasts to the cytosol in leaf tissues via a plastidic maltose transporter, AtMEX1, is essential for normal plant growth. However, such a starch utilization pathway has not yet been characterized in rice (Oryza sativa), a monocot model plant. Examination of expression profiles of a rice plastidic maltose transporter, OsMEX1, by real-time polymerase chain reaction showed that it is abundant in the pollen grain-containing stamens of mature flowers. Consistently, high performance liquid chromatography analysis revealed a relatively high maltose content in mature flowers, suggesting that OsMEX1 mainly functions in the tissues. OsMEX1-green fluorescent protein fusion experiment confirmed that OsMEX1 localizes at the chloroplast envelope in both rice and Arabidopsis. Arabidopsis maltose excess1 (mex1) mutant was transformed with OsMEX1 fused to the cauliflower mosaic virus 35S (CaMV35S) promoter. In the resulting transgenic plants, the typical mutant phenotypes of Arabidopsis mex1, such as chlorosis, stunted growth, and maltose and starch deposition at the end of the night, are clearly rescued. This result demonstrates that OsMEX1 functions as a plastidic maltose transporter in Arabidopsis. Our present findings thus suggest that whereas the Arabidopsis MEX1 gene essentially functions in source leaf tissues, its rice counterpart likely has a role in the pollens of mature flowers.

**Jin Young Kim, Yeon-Ki Kim, Young Mee Kim, Seogjae Lee, Sanggyu Park, Baek Hie Nahm, Dong-Sun Lee, Moonjae Cho. Proteasome down-regulation is partly mediated by Slug/Snail2 in hepatocarcinoma cells. J. Korean Soc. Appl. Biol. Chem. 56(2):157-163**

Snail family proteins (Snail1 and Slug/Snail2) are transcription factors that regulate transcription of molecules during epithelial-mesenchymal transition (EMT). Snail1/2 is known to bind to the E-box motif (CANNTG). The proteasome activity is decreased in EMT (Kim et al., 2011), and several E-box motifs are found in the promoters of genes coding for proteasome subunits. We used a new protein-binding microarray to specify the Slug/Snail2 binding sequence. Among 563 9-mer clusters, the motif **CACCTGC** yielded the highest P-value in the Wilcoxon-Mann-Whitney test. Within this motif, the A and T were absolutely required, and CC was preferred, but could be replaced by GG with little effect. In hepatocytes overexpressing Slug/Snail2, the 20S proteasome expression and proteasome activity were decreased partly due to the down-regulation of proteasome subunit beta type 2 (PSMB2) and PSMB3 transcription.

**Lan Hee Kim, Hye-Weon Yu, Yang-Hoon Kim, In S. Kim, Am Jang. Potential of fluorophore labeled aptamers for *Pseudomonas aeruginosa* detection in drinking water. J. Korean Soc. Appl. Biol. Chem. 56(2):165-171**

Pseudomonas aeruginosa has been considered as a representative pathogenic bacteria in drinking water. In order to detect P. aeruginosa, aptamers were utilized in this study. In particular, fluorescein isothiocyannate (FITC) and quantum dot (QD) were used for aptamer labeling. FITC-labeled aptamers showed higher binding capacity with optimal incubation time of 30 min compared to QD-labeled aptamers. However, incubation speed did not have any effect on the binding capacity of FITC-labeled aptamers to bacteria. Aptamer-binding capacity was measured according to varying cell concentrations of 0, 10, 100, and 1000 cells/mL. As a result, the limit of detection, limit of quantification, and limit of linearity of P. aeruginosa were 5.07, 5.64, and 100 cells/mL, respectively. The low detection limit shows the fluorophore-labeled aptamer potential to detect P. aeruginosa labeling in the field.

**Hyun Kim, Seong-Hun Jeong, Dong-Gyu Kam, Hyun-Jun Kim, Soo-Min Choi, Myung Bo Lee, Sang Won Bae, Joo Hoon Lim, Sang-Hyun Lee. Developing a site index model considering soil characteristics for *Pinus thunbergii* stands grown on the west coast of Korea. J. Korean Soc. Appl. Biol. Chem. 56(2):173-180**

Height model of the dominant tree was developed and derived site index curves of Pinus thunbergii, which is the main species of windbreak forests along the west coast of Korea. The site index of a tree is affected by various environmental factors. In the present study, however, the soil characteristics of P. thunbergii stands, which are scattered along the west coast of Korea were used. Eight sites of windbreak forest were investigated from October 2011 to October 2012. The Schumacher polymorphic equation was the most suitable equation to develop a site index model of P. thunbergii stands, and it was the best site index model when Ca-P and fungus were applied to the asymptotic parameter (α). The equation yielded site index curves using the developed model, which is based on trees aged 50 years, considering the soil characteristic factors of P. thunbergii stands in different areas. The site index model and site index curves suggest important growth information, such as windbreak forests, green spaces development, and height growth estimation, which are needed for management of the stands, with consideration of the proposed soil characteristic factors of this study.

**Hyeri Lee, Myoungjoo Riu, Eunhye Kim, Joon-Kwan Moon, Hoon Choi, Jung-A Do, Jae-Ho Oh, Ki-Sung Kwon, Young Deuk Lee, Jeong-Han Kim. A single residue method for the determination of chlorpropham in representative crops using high performance liquid chromatography. J. Korean Soc. Appl. Biol. Chem. 56(2):181-186**

A single residue analytical method was developed for herbicide chlorpropham in various crops. Brown rice, apple, mandarin, Kimchi cabbage, green pepper, potato, and soybean were selected as representative crops, and clean-up system, partition solvent, and extraction solvent were optimized. For high performance liquid chromatography (HPLC), C18 column was used with elution solvents of water and acetonitrile. Limit of quantitation (LOQ) of chlorpropham was 2 ng (S/N >20), and excellent linearity (R2=1.000) was achieved. Method limit of quantitation (MLOQ) was 0.02 mg/kg. For recovery tests, crop samples were macerated and fortified with chlorpropham standard solution at three fortification levels (MLOQ, 10 MLOQ, and 100 MLOQ). And then those were extracted with acetonitrile, concentrated and partitioned with n-hexane. The n-hexane layer was then concentrated, cleaned-up through Florisil® column with ethyl acetate:n-hexane (5:95, v/v) prior to concentration and analysis with HPLC. Good recoveries from 76.8 to 107.9% with coefficients of variation of less than 10% were obtained, regardless of sample type, which satisfies the criteria of Korea Food and Drug Administration. Those results were confirmed with liquid chromatography-mass spectrometry (LC-MS). The method established in this study could be applied to most of crops as an official and general method for the analysis of chlorpropham residue.

**Lei Li, Gui-sheng Zeng, Sheng-lian Luo, Xiao-rong Deng, Qing-ji Xie. Influences of solution pH and redox potential on the bioleaching of LiCoO2 from spent lithium-ion batteries. J. Korean Soc. Appl. Biol. Chem. 56(2):187-192**

The influences of solution pH and redox potential on bioleaching of LiCoO2 from spent lithium-ion batteries using Acidithiobacillus ferrooxidans were investigated. Bioleaching at different initial pH and ferrous ion (Fe2+) concentrations were carried out, and electrochemical behavior of LiCoO2 dissolution was examined to study the effect of solution redox potential on the bioleaching process. The results showed maximum cobalt dissolution at initial pH of 1.5 and initial Fe2+ concentration of 35 g/L, and cobalt dissolution showed only slight relationship with pH of solution. Nonetheless, there was improvement of cobalt dissolution at higher redox potential. The cyclic voltammograms showed that dissolution rates increase when the solution potentials are higher than 0.4 V, and rapid decrease at 1.3 V. The anodic polarization curves indicated that the corrosion, primary passive, and passivation potentials were 0.420, 0.776 and 0.802 V, respectively.

**Myeong Hoon Joo, Ji Yeon Kim. Characteristics of crude oil biodegradation by biosurfactant-producing bacterium *Bacillus subtilis* JK-1. J. Korean Soc. Appl. Biol. Chem. 56(2):193-200**

The production of biosurfactant by Bacillus subtilis JK-1 was investigated under several conditions. In sea water inoculated with 10% (v/v) of seed culture, the surface tension decreased from 75.0 to 38.4 dyne/cm after 12 h of incubation, which was the highest reduction of surface tension (49%) among the conditions tested. Surface tension further decreased to 31.2 dyne/cm when grown in 1% (v/v) B. subtilis JK-1 inoculated into sea water containing 1% (v/v) crude oil. The decrease of surface tension was similar after 24 h in sea water, sea water containing 1% (v/v) crude oil, and sea water containing 10% (v/v) crude oil using a 10% (v/v) B. subtilis JK-1 inoculum. The biosurfactant produced by B. subtilis JK-1 displayed highest emulsification activity on soybean oil and crude oil. Maximum emulsification stability was obtained from hexane (C6). Using crude oil as a substrate, the emulsification activity of the biosurfactant was much greater than those of chemically synthesized surfactants such as Tween 20 and sodium dodecyl sulfate (SDS). In addition, the bacterial biosurfactant possessed the best emulsification stability when hexane (C6), and hexadecane (C16) were utilized as substrates, as compared to Tween 20, Triton X-100, and SDS. The crude oil in the culture broth was degraded by B. subtilis JK-1, and the C1–C29 carbon chain was almost completely degraded during the 48 h incubation. These results suggest that the biosurfactant of B. subtilis JK-1 is an appropriate candidate for bioremediation of crude oil contaminant.

**Su-Yeon Back, Hyun-Ku Kim, Sang-Dong Lim, Gun-Pyo Do, Jeong-Ryong Do. Development of antihypertensive natural seasoning using beef hydrolyzate. J. Korean Soc. Appl. Biol. Chem. 56(2):201-206**

Natural seasoning with antihypertensive effect was developed using beef hydrolyzate. Quality of the natural seasoning product was compared with five concentrations of beef hydrolyzates at 0, 5, 10, 15, and 20%. Optimum conditions of beef hydrolyzate were determined to be Alcalase 2.4 L 1%, beef concentration 5%, and 4 h of hydrolysis. Angiotensin-converting enzyme (ACE) inhibitory activity of beef hydrolyzate was increased by 70.2% as compared to that of control under the same condition. Sensory evaluation results showed that natural seasoning with 15% beef hydrolyzate was acceptable with salty and savory taste. ACE inhibitory activity of the seasoning with 15% beef hydrolyzate was increased by 41.7% compared to control. Amino acid compositions of natural seasoning in 15% beef hydrolyzate were taurine (511.3mg%), glutamine (846.2mg%), glycine (120.6mg%), and ammonia (NH3) (105.7 mg%). Optimal composition of the seasoning product was: 15% beef hydrolyzate mixed with 1.7% red pepper powder, 4.25% crab water extract, 10.2% kelp powder, 1.7% garlic powder, 10.2% anchovy powder, 10.2% short-necked clam powder, 12.75% shrimp powder, 17% beef powder, 12.75% shiitake powder, and 4.25% freeze-dried pollock powder. The seasoning with 15% beef hydrolyzate may have antihypertensive effects with high consumer acceptability.

**Na-Young Choi, Bo-Ram Kim, Young-Min Bae, Sun-Young Lee. Biofilm formation, attachment, and cell hydrophobicity of foodborne pathogens under varied environmental conditions. J. Korean Soc. Appl. Biol. Chem. 56(2):207-220**

Biofilm formation, attachment and cell hydrophobicity of foodborne pathogens, including Listeria monocytogenes, Pseudomonas aeruginosa, and Staphylococcus aureus were investigated under various environmental conditions such as sodium chloride (0.5–7.0%, w/v), glucose (0.25–10.0%, w/v), pH (6.0–6.8), temperature (25 and 37°C), incubation time (24 and 6 h), and nutrients trypic soy broth (TSB) and diluted TSB (1:10). Biofilm formation for 24 h at 25 and 37°C and attachment for 30 min and 6 h on the surface of polystyrene were measured by the crystal violet staining method. Cell hydrophobicity of pathogens for 6 and 24 h at 25 and 37°C was conducted using the modified bacterial adherence to hydrocarbons method (mBATH). Biofilm formation and attachment of pathogens were highly influenced by the addition of glucose and sodium chloride compared to pH. The biofilm of all pathogens formed in TSB was greater than that in diluted TSB. Biofilm formations of S. aureus and P. aeruginosa at 37°C were greater than that at 25°C. However, biofilm formation of L. monocytogenes was not significantly affected by temperature. Levels of L. monocytogenes hydrophobicity were influenced by adding glucose and sodium chloride at 37°C, whereas levels of hydrophobicity for other pathogens were significantly different depending on the glucose condition (p <0.05). The results demonstrate that biofilm formation, attachment, and hydrophobicity of pathogens were affected by environmental conditions such as the addition of glucose and sodium chloride. However, factors affecting biofilm formation and cell hydrophobicity differed depending on the pathogen type.

**Dong Min Kim, Nari Lee, Seung Min Kim, Soo Hyun Chung, Meehye Kim, Sang Bae Han, Hyang Sook Chun. Occurrence of aflatoxin and aflatoxigenic *Aspergillus* species in corn harvested in Korea. J. Korean Soc. Appl. Biol. Chem. 56(2):221-225**

Sixty six corn samples freshly harvested in Korea were analyzed for the occurrence of aflatoxin and aflatoxigenic Aspergillus using chromatographic and multiplex polymerase chain reaction (PCR) methods. Aflatoxin and aflatoxigenic Aspergillus were detected in 13.6% (0.02 to 0.48 μg kg−1) and 3.0% of the corn samples, respectively. Aflatoxigenic Aspergillus isolates and A. flavus KCCM60330 showed high similarity (98–98.8%). These results suggest that occurrence of aflatoxin and aflatoxigenic Aspergillus in corn harvested from Korea is low.

**Hee-Don Choi, Jeong-Jun Han, Ji-Hee Yang, Sang-Hoon Lee, Yun-Sook Kim, Guk-Hoon Chung, Dae-Hyun Hahm. Effect of soy phosphatidylserine supplemented diet on skin wrinkle and moisture *in Vivo* and clinical trial. J. Korean Soc. Appl. Biol. Chem. 56(2):227-235**

Effect of supplementation of phosphatidylserine (PS), enzymatically synthesized from soy lecithin, on skin moisture and wrinkle in animal and human was investigated. Skin moisture content of hairless mice was significantly decreased and skin thickness and wrinkle were significantly increased by UV irradiation, whereas PS-supplemented groups showed reduced wrinkle depth and much less wrinkle area unlike UV control (UV/Con) group. The collagen content in PS-supplemented groups increased compared with that in UV/Con group. A placebo-controlled double-blind intake study of soft capsules containing PS (300 mg/day) was performed on 63 subjects who had normal healthy skin for 12 weeks. Dermatologist’s visual assessment and image analysis of replicas showed that wrinkle near eye was improved by PSsupplementation. Upon measurement of moisture content in the skin, PS supplementation increased the moisture content in the skin. These findings showed that PS supplementation was effective in moisturizing and improving wrinkle of the skin in both animal and human; thus, PS could be used as an effective skin food ingredient.

**Jong-Hwa Park, Yuan-Yuan Fu, In Sik Chung, Tae-Ryong Hahn, Man-Ho Cho. Cytotoxic property of ultraviolet-induced rice phytoalexins to human colon carcinoma HCT-116 cells. J. Korean Soc. Appl. Biol. Chem. 56(2):237-241**

Exposure to ultraviolet (UV) radiation increased the cytotoxic effect of rice leaf extract on human colon carcinoma HCT-116 cells, suggesting that the production of cytotoxic compounds in rice leaves are induced by UV treatment. To identify cytotoxic agents in UV-treated rice leaves, the phenolic compound peaks prominently increased by UV treatment were isolated using reversed phase high performance liquid chromatography (HPLC). The isolated compounds were identified as N-trans-cinnamoyltyramine, N-benzoyltryptamine, and sakuranetin using NMR and mass spectrometric techniques. N-Benzoyltryptamine and sakuranetin were previously reported as rice phytoalexins, and N-trans-cinnamoyltyramine was first isolated from rice. N-Benzoyltryptamine and sakuranetin were found to inhibit the growth of HCT-116 cells with IC50 values of 89.2±4.8 and 68.8±5.2 μg/mL, respectively, indicating that these phytoalexins are cytotoxic agents in the UV-treated rice leaves. These results suggest that rice phytoalexins are potent anti-cancer agents and UV-treated rice leaves are valuable source for therapeutic agents.

**Bong Soo Park, Sung-Il Kim, Hak Soo Seo. AtSIZ1 regulates expression of nitrite reductase but not its activity. J. Korean Soc. Appl. Biol. Chem. 56(2):243-245**

Plant nitrite reductase (NiR) catalyzes the reduction of nitrite to ammonium. We examined if NiR activity is regulated by sumoylation, and found NiR was not sumoylated by E3 small ubiquitin-related modifier ligase AtSIZ1. However, its transcript level decreased in the siz1-2 mutant, indicating that AtSIZ1 does not directly control NiR activity.

**Yasir Anwar, Seong-Yeol Baek, Soo-Hwan Yeo, Heui-Dong Park. Occurrence of *Issatchenkia orientalis* exhibiting inhibitory effects against soybean lipoxygenase in Korean *nuruk.* J. Korean Soc. Appl. Biol. Chem. 56(2):247-250**

Three yeast strains (designated SHA, SHC, and SHD) exhibiting strong inhibitory effects against soybean lipoxygenase were isolated from Korean nuruk and identified as Issatchenkia orientalis. Total 80 yeast isolates from two major Korean nuruk samples were analyzed by polymerase chain reaction-restriction fragment length polymorphism and phylogenetic analysis. The most abundant yeast was identified as Pichia anomala, comprising 47 out of 80 strains, followed by 15 strains of I. orientalis. All 15 I. orientalis strains showed significant inhibitory effects against soybean lipoxygenase, higher than that of Saccahromyces boulardii used as a positive control.

**Jae-Hwan Kim, Eun-Hee Kim, Mi-Chi Yea, Hae-Yeong Kim. Validation of A multiplex PCR detection kit for screening of herbicide-tolerant genes in genetically modified crops. J. Korean Soc. Appl. Biol. Chem. 56(2):251-254**

A multiplex polymerase chain reaction (PCR) detection kit for screening of four herbicide-tolerant genes (cp4 epsps, mepsps, pat, and bar) in genetically modified (GM) crops was developed. The kit was validated by three different laboratories, and the expected targets were specifically observed in 14 different herbicide-tolerant GM events. This method can be effectively and conveniently used to monitor approved and unapproved GM crops containing four herbicide-tolerant genes.

**Hien Thi Thanh Nguyen, Kyoung Su Choi, SeonJoo Park. Genetic diversity and differentiation of a narrowly distributed and endemic species, *Aster spathulifolius* maxim (Asteraceae), revealed with inter simple sequence repeat markers. J. Korean Soc. Appl. Biol. Chem. 56(3):255-262**

Aster spathulifolius Maxim is a narrowly distributed and endemic species occurring in coastal regions of Korea and Japan. The genetic diversity and differentiation of fifteen populations of the species were analyzed in eight-two loci using six Inter Simple Sequence Repeat primers. Total genetic diversity at species level was extremely high (P=98.78%, Hsp=0.333±0.144, I=0.501±0.180), whereas the genetic diversity at population level was relatively low (P=43.74%, Hpop=0.150±0.189, I=0.227±0.274). High genetic differentiation among populations was detected based on genetic differentiation coefficient (Gst=0.549) and analysis of molecular variance (AP=54.06%). These findings together with low gene flow estimates (Nm=0.205) suggest that genetic drift by isolation is the most critical factor for establishing the current genetic structure of the species. The decrease in abundance of A. spathulifolius along with low levels of genetic diversity indicates that conservation strategies are necessary.

**Zongpei Zhao, Priyadharshini Ramachandran, Joon-Ho Choi, Jung-Kul Lee, In-Won Kim. Purification and characterization of a novel β-1,3/1,4-glucanase from *Sistotrema brinkmannii* HQ717718. J. Korean Soc. Appl. Biol. Chem. 56(3):263-270**

A highly efficient extracellular β-1,3/1,4-glucanase was purified from the culture broth of Sistotrema brinkmannii HQ717718. The molecular mass of β-1,3/1,4-glucanase was respectively determined to be 83 and 166 kDa by sodium dodecyl sulfate-polyacrylamide gel electrophoresis and gel filtration chromatography, indicating that the enzyme is a dimer. The optimum activity of β-1,3/1,4-glucanase against Avicel was observed at pH 4.0 and 65°C. Under the same conditions, Vmax, Km, and kcat values for Avicel were 136.5 U · mg−1 of protein, 3.8 mM, and 211 s−1, respectively. Furthermore, the DNA sequence of gene coding the enzyme showed a significant homology with hydrolases from the glycoside hydrolase family 55. Although β-1,3/1,4-glucanases have been purified and characterized from several other sources, S. brinkmannii β-1,3/1,4-glucanase is distinct from other β-1,3/1,4-glucanases due to its high catalytic efficiency toward Avicel and broad substrate specificity.

**Seong Beom Jin, Hyeon Jin Sun, Md Adnan Al Bachchu, Sung Jin Chung, Jongwoo Lee, Song-I Han, Jeong Hun Yun, Kyung Whan Boo, Dongsun Lee, Key Zung Riu, Jae-Hoon Kim. Production of recombinant miraculin protein using transgenic citrus cell suspension culture system. J. Korean Soc. Appl. Biol. Chem. 56(3):271-274**

Miraculin gene containing the N-terminal signal peptide was introduced into navel orange (Citrus sinensis Osb. var. brasiliensis Tanaka) callus cells by Agrobacterum-mediated transformation. Transgenic somatic embryos were screened on the shoot induction medium containing 25 mg hygromycin L−1. Citrus callus cells were reproduced from the green color somatic embryos on the callus reproduction medium. The obtained transgenic cells were cultured in Murashige and Tucker’s liquid medium containing 50 g sucrose L−1 in a shaking incubator. Similar to the native miraculin, the secreted recombinant miraculin protein formed a disulfide-linked dimer and retained taste-modifying activity. The stability of recombinant protein expression was confirmed over nine generations of callus. This production system can be an excellent alternative for producing various recombinant proteins as well as miraculin.

**Ramasamy Rajesh Kumar, Jae Young Cho. *In vitro* bionics of face centered cubic lattice crystal nanoparticles by *Saccharomyces cerevisiae* and its microbicidal screening. J. Korean Soc. Appl. Biol. Chem. 56(3):275-278**

Extracellular synthesis of nanoparticles has received attention due to its more advantageous form of synthesis in large quantities and also easy for downstream processing. In the present investigation, we report in vitro extracellular synthesis of silver nanoparticles (AgNPs) using Saccharomyces cerevisiae with silver nitrate solution. The AgNPs were produced in 72 h of incubation time. The AgNPs formed were further characterized by means of UV-Vis spectrophotometry, Fourier Transform Infra-Red (FTIR), X-Ray Diffraction (XRD), and Scanning Electron Microscope (SEM). The synthesized AgNPs had maximum absorbance at ∼420 nm in the UV-visible region. FTIR bands were observed at 3353.40, 2075.09, 1637.71 and 1397.30 cm−1. XRD patterns of the AgNPs confirmed the formation of face centered cubic (fcc) lattice crystal silver particles. The SEM analysis revealed that the size of the AgNPs were of 30–60 nm. The synthesized AgNPs inhibited the growth of the test microorganisms at the concentration of 100 μL. The present study highlights the possibility of using the common baker’s yeast S. cerevisiae to synthesize AgNPs and as a microbicidal agent.

**Byungsoo Kim, Jiyeon Kim. Optimization of culture conditions for the production of biosurfactant by *Bacillus subtilis* JK-1 using response surface methodology. J. Korean Soc. Appl. Biol. Chem. 56(3):279-287**

Optimization of culture conditions for the production of biosurfactant by Bacillus subtilis JK-1 was carried out using central composite rotatable design (CCRD) of response surface methodology (RSM). The variables selected for optimization of culture conditions were soluble starch, skim milk, KNO3 concentrations, and temperature. Response surface analysis showed that the fitted quadratic model had adequately high R2 value of 0.9882 and low significance probability of <0.0001, which indicated the statistical significance of the model. The optimum levels of each variable were determined to be as follows: 1.550% (w/v) soluble starch, 0.477% (w/v) skim milk, 0.096% (w/v) KNO3 and 37.145°C. Through the statistical analysis, temperature and soluble starch were found to be the most significant factors, whereas skim milk and KNO3 had less effect within the ranges investigated. Our results could be very helpful in the large-scale production of biosurfactant from B. subtilis JK-1.

**Seong Yeong Kim, Ho Lee. Effect of quality characteristics on brown rice produced from paddy rice with different moisture contents. J. Korean Soc. Appl. Biol. Chem. 56(3):289-293**

Relationship between moisture content of paddy rice and quality characteristics of dehusked brown rice was investigated using paddy rice samples with different moisture contents (11, 13, 15, 17, and 19%). General characteristics of brown rice such as yield, normal, immature, damaged, chalky, discolored, and cracked brown rice ratios, hardness, and whiteness were determined. The results showed that brown rice with 15 and 17% moisture contents had relatively higher values for all quality tests compared to those of the other rice samples with the exception of cracked brown rice ratio. The cracked brown rice ratio increased with the increase in moisture content (p <0.05), whereas hardness of the brown rice decreased with the increase in moisture content (p <0.05). These results suggest that paddy rice with 15–17% moisture content produce high quality brown rice.

**Minseon Koo, Ae-Ri Cho, A-Ram Jeong, Hyun Jung Kim, Yong-Ho Park, Hyo-Sun Kwak, In-Gyun Hwang. Antibiotic susceptibility and molecular typing of *Enterococcus faecalis* from retail pork meat products in Korea. J. Korean Soc. Appl. Biol. Chem. 56(3):295-299**

Enterococci have been used as starter cultures and probiotics. They also have been considered as indicator organisms for antibiotic resistance due to their ability to harbor and to easily acquire antibiotic resistance. This study aimed to show the antimicrobial resistance profiles and genotyping of Enterococcus faecalis in retail pork meat products in Korea. Enterococcus spp. were analyzed for 124 collected samples, which included minced pork meat, marinated pork meat with soy sauce or kochujang (fermented hot pepper-soybean paste), and frozen processed pork meat products. The isolates of E. faecalis (n=36) were resistant to tetracycline (58.3%), erythromycin (11.1%), and nitrofurantoin (2.8%). No vancomycin resistant enterococci were observed in the present study. Most of the E. faecalis isolates were sensitive to all antibiotics or resistant to single antibiotics. As a result of the automated repetitive-sequence-based PCR (rep-PCR), which was used as an approach for genotyping enterococci, 7 out of 36 isolates of E. faecalis were assigned to one cluster with a similarity >95%, and all isolates were found to have originated from minced pork meat, suggesting that this clone might circulate in minced pork meat products. Given the importance of antimicrobial resistance of enterococci in food safety as well as in public health, our results on the occurrence, antimicrobial resistance, and genotyping could provide useful information to derive risk management options.

**Ji-Hoon Kang, Ho-Hyun Chun, Nak-Bum Song, Min-Sung Kim, Jiyong Park, Deog-Hwan Oh, Kyung Bin Song. Effects of electron beam and ultraviolet-C irradiation on quality and microbial populations of leafy vegetables during storage. J. Korean Soc. Appl. Biol. Chem. 56(3):301-307**

Effects of ultraviolet-C (UV-C) and electron beam irradiation on the quality and microbial populations of leafy vegetables were compared as a microbial decontamination method. Tatsoi and red chard leaves were treated with UV-C at a dose of 5 kJ/m2 or by electron beam irradiation at doses of 0.5, 1, and 3 kGy. After UV-C or electron beam irradiation treatment, the samples were stored at 4 ± 1°C for 11 days. Populations of total aerobic bacteria in leafy vegetables decreased by 0.8–1.1 log CFU/g after treatment with UV-C irradiation, and those of yeast and molds decreased by 1.0–1.8 log CFU/g. On the contrary, electron beam irradiation at 0.5 or 1 kGy reduced the microbial populations by 2.0–2.5 log CFU/g. Electron beam irradiation at 3 kGy eliminated the microorganisms in the samples. These results suggest that electron beam irradiation at low dose below 3 kGy can be more effective than UV-C treatment for the inactivation of microorganisms in Tatsoi and red chard leaves.

**Ho Hyun Chun, Ji Hoon Kang, Kyung Bin Song. Effects of aqueous chlorine dioxide treatment and cold storage on microbial growth and quality of blueberries. J. Korean Soc. Appl. Biol. Chem. 56(3):309-315**

The effects of postharvest washing treatment and cold storage on the quality of blueberries were examined. The blueberries were treated with water or 100 ppm aqueous chlorine dioxide (ClO2) and stored at 4 or 20°C for 12 days. The aqueous ClO2 treatment reduced the initial populations of total aerobic bacteria and yeast and mold in the blueberries by 1.4–1.5 and 0.8–0.9 log CFU/g, respectively, compared with the control. Total anthocyanin content indicated that the blueberries stored at 4°C maintained their total anthocyanin content better than those stored at 20°C. Regardless of washing treatment, the blueberries stored at 4°C exhibited lower decay and weight loss than those stored at 20°C. These results suggest that a postharvest treatment of aqueous ClO2 and cold storage can be useful for maintaining the quality of blueberries during storage.

**Hui Teng, Won Young Lee. Optimization of microwave-assisted extraction of polyphenols from mulberry fruits (*Morus alba* L.) using response surface methodology. J. Korean Soc. Appl. Biol. Chem. 56(3):317-324**

Polyphenols in mulberry fruit were fast extracted using a microwave-assisted extraction technique, and the effects of process variables including the solvent concentration, irradiation time, microwave power, and solvent consumption upon polyphenol extraction were investigated. Fifteen runs rotatable box-behnken design (RBBD) with three variables and three levels were employed; optimal conditions and maximal yields of the total polyphenol and flavonoid contents were predicted by generating a mathematical polynomial model based on response surface methodology. The estimated optimal conditions were ethanol concentration of 40%, irradiation time of 8 min, and microwave power of 210 W. A verification experiment was carried out at the above mentioned optimal conditions, and no significant differences were observed between the predicted and experimental values, which confirmed that the prediction was valid and application of response surface methodology (RSM) to the extraction of polyphenols and flavonoids from mulberries under microwaveassisted extraction (MAE) process was successful. In addition, specific polyphenols contained in mulberries were identified and quantified using high performance liquid chromatograph.

**Su-Jeong Ha, Yun-Ji Kim, Se-Wook Oh. Effect of high hydrostatic pressure (HHP) treatment on chemical and microbiological properties of *Makgeolli.* J. Korean Soc. Appl. Biol. Chem. 56(3):325-329**

Chemical and microbiological properties of Makgeolli after high hydrostatic pressure (HHP) treatment were investigated to determine the possibility of shelf-life extension. Laboratory prepared Makgeolli was treated with 400MPa for 5 min and stored for 6 days at 25°C and chemical and microbial properties were analyzed. On day 6 the alcohol content of untreated Makgeolli was 8.27%, whereas HHP-treated showed 7.50%, and pH were 2.76 and 3.22, respectively. Titratable acidity of HHPtreated Makgeolli was increased by less than 0.1%, whereas the untreated was increased by more than 0.3% on day 6. Reducing sugar content, on the other hand, increased continuously in HHP-treated Makgeolli, and reached to 2.43% by day 6, but decreased to 1.13% in untreated Makgeolli. In HHP-treated Makgeolli, yeast was reduced to below detection limit and grew again on day 6. Lactic acid bacteria were also reduced by HHP, but reappeared within 2 days at the level of 1-2 logs CFU/mL. HHP slowed down the chemical changes such as pH, titratable acidity, and alcohol content; thus showing HHP treatment can be used to extend the shelf-life of Makgeolli by inactivating lactic acid bacteria and yeast.

**Min-Gi Kim, Ji-Yeon Yang, Hoi-Seon Lee. Phototactic behavior: Repellent effects of cigarette beetle, *Lasioderma serricorne* (Coleoptera: Anobiidae), to light-emitting diodes. J. Korean Soc. Appl. Biol. Chem. 56(3):331-333**

Repellent effects of specific light wavelengths against the cigarette beetle were evaluated in blue (470 nm), green (520 nm), yellow (590 nm), and red (625 nm) light-emitting diodes (LEDs). Under optimal light conditions (100 lx luminance intensity, 2 h light exposure time), the blue LED (59%) was the most repellent to Lasioderma serricorne adults, followed by green (34.3%), yellow (31.3%), and red (29.3%) LEDs. Moreover, the blue LED was approximately 1.3 times more repellent to L. serricorne adults than a luring lamp black light (BL), 45.7%. These results suggest that blue LEDs could be used for environmentally friendly insect control.

**Kyung Hwan Boo, Doseung Lee, Quyen Van Nguyen, Seong Beom Jin, Seungtae Kang, Cao Dang Viet, Se Pill Park, Dong-Sun Lee, Key Zung Riu. Fluctuation of 20-hydroxyecdysone in individual organs of *Achyranthes japonica* during reproductive growth stage and its accumulation into seed. J. Korean Soc. Appl. Biol. Chem. 56(3):335-338**

To better understand 20-hydroxyecdysone (20E) fluctuation and accumulation in perennial plant, 20E concentration in individual organs of Achyranthes japonica during reproductive growth stage were analyzed by high performance liquid chromatography (HPLC). Concentrations of 20E in root and floral part were much higher than those in stem and leaf during reproductive growth stage and rapidly increased from flowering stage in August to seed-setting stage in October, and thereafter decreased at the stage of seed maturing in November. In contrast, the 20E concentrations in stem and leaf gradually decreased during reproductive growth. In the analysis of detailed fluctuation of 20E in floral part, the 20E concentration was highest in the seed at the early stage of seed development, compared to flower, peduncle, seed coat, and/or seed in other growth stages, and decreased during seed maturation. The accumulation of 20E in reproductive organs, especially seed and root, suggests that 20E has a defensive role for protection of especially newly developing organs against phytophagous insects.

**Sunhwa Park, Ji-Hoon Lee, Yong-Joon Cho, Jongsik Chun, Hor-Gil Hur. Draft genome sequence of *Pseudomonas* sp. strain G5, isolated from a traditional indigo fermentation dye vat. J. Korean Soc. Appl. Biol. Chem. 56(3):339-341**

In previous study, alkaliphilic and thermotolerant bacterium strain, Pseudomonas sp. strain G5, capable of reducing insoluble indigo was isolated from Korean traditional fermentation liquor. Here, we report the draft genome sequence and annotation of strain G5 to provide the genomic information involved in indigo reduction process.

**Jong Min Lee, Soon Young Shin, Hyuk Yoon, Mi So Lee, You Ri Lee, Dongsoo Koh, Young Han Lee. Synthesis and biological evaluation of a novel pyrazolecarbothioamide derivative (DK115) inducing cell cycle arrest at the G1 phase in HCT116 human colon cancer cells. J. Korean Soc. Appl. Biol. Chem. 56(3):343-347**

A novel compound, 5-(2,3-dimethoxyphenyl)-3-(1-hydroxynaphthalen-2-yl)-N-(4-methoxyphenyl)-4,5-dihydro-1H-pyrazole-1-carbothioamide (designated DK115) was synthesized, and its antitumor efficacy was assessed. Exposure of DK115 to HCT116 human colon cancer cells inhibited cellular proliferation and clonogenicity. DK115 induced cell cycle arrest at the G1 phase. DK115 downregulated cyclin D1 expression, whereas upregulated p53 and p21 expressions. DK115-induced p21 was not observed in HCT116 cells lacking the p53 gene (p53−/−), suggesting that DK115 induces p21 expression via p53. These data demonstrate that a novel synthetic DK115 compound may possess antitumor activity through the induction of tumor suppressor p53-mediated G1 cell cycle arrest.

**Joungsu Joo, Youn Hab Lee, Dong Hee Choi, Jong-Joo Cheong, Yeon-Ki Kim, Sang Ik Song. Rice ASR1 has function in abiotic stress tolerance during early growth stages of rice. J. Korean Soc. Appl. Biol. Chem. 56(3):349-352**

OsASR1 expression was induced through Abscisic acid (ABA) and stress treatments in leaves. The constitutive overexpression of OsASR1 in rice reduced ABA sensitivity, and increased high salinity and osmotic stress tolerance in early growth stages. These results indicated that OsASR1 has function in abiotic stress tolerance during early growth stages of rice.

**Mi Kyoung Kim, Youhoon Chong. Design, synthesis, and biological evaluation of resveratrol derivatives as PPARα agonists. J. Korean Soc. Appl. Biol. Chem. 56(3):353-356**

The peroxisome proliferator-activated receptor subtype α (PPARα) was established as a molecular target in drug discovery research for new lipid-lowering drugs. Pterostilbene is a naturally occurring PPARα agonist that has been shown to lower plasma lipid concentrations via the activation of PPARα. In this study, various pterostilbene conjugates with methyl, amino acid, and pivaloxymethyl (POM) groups at the 4-OH position were synthesized, and the activating effect on PPARα were investigated. Of the conjugates investigated, 4-OMe-pterostilbene had lower activating effect than pterostilbene, but the pterostilbenes with either amino acid (4a and 4b) or POM moiety (5) showed a small but significant increase in PPARα activation of PPARα activity compared to pterostilbene. Therefore, the structure-activity relationship of the pterostilbene conjugates studied indicates that substitution of the free 4-OH moiety of pterostilbene with a nonmethyl group can increase PPARα agonistic activity. This finding warrants further investigation of the structure-activity relationship of the pterostilbene conjugates as potent PPARα agonists.

**Hoon Choi, Jeong-Han Kim. Volatile constituents of herbicide glufosinate-tolerant and non-transgenic rice by solvent-assisted flavor evaporation and gas chromatography-mass spectrometry. J. Korean Soc. Appl. Biol. Chem. 56(3):357-360**

The volatile components in leaves and roots of two glufosinate-tolerant rice varieties, Iksan483 and Milyang204, and conventional rice were extracted by solvent-assisted flavor evaporation prior to gas chromatography-mass spectrometry analysis. Five volatiles were identified in rice leaves as common constituents, whereas eight volatiles were identified in rice roots. These compounds include metabolites of different chemical groups such as acids, aldehydes, ketones, alcohols, phenols, and terpenes. In rice leaves, major volatile compounds were trans-2-hexenal (0.62–16.45 μg/g) and 3-methyl butanoic acid (0.43–1.36 μg/g). Benzyl alcohol (1.31–5.37 μg/g), hexanal (0.41–1.32 μg/g), and nonanal (0.33–1.14 μg/g) were detected as the major volatiles in rice roots. Statistically significant differences were not observed in contents of all volatiles isolated from varieties, according to results of the one-way analysis of variance at the 0.05 level, suggesting that the volatile composition of transgenic rice fall within the range of non-transgenic counterparts.

**Jannu Vinay Gopal, Ethiraj Subashini, Krishnan Kannabiran. Extraction of quinone derivative from *Streptomyces* sp. VITVSK1 isolated from Cheyyur saltpan, Tamilnadu, India. J. Korean Soc. Appl. Biol. Chem. 56(4):361-367**

Extraction of pigments from natural sources is gaining momentum due to many biological applications. The aim of our study was to extract and to identify the pigment produced by Streptomyces species isolated from saltpan soil samples. The pigment-producing isolate was characterized by molecular taxonomy, identified as Streptomyces species, and designated as Streptomyces sp. VITVSK1. The isolate produced green color pigmentation upon solid substrate fermentation using parboiled rice as a media for 7 days at 37°C. The pigment derivative was extracted using methanol as solvent and purified by silica gel column chromatography and preparative thin layer chromatography using chloroform: methanol as solvent system. The purified compound was identified as 2,5-di-tert-butyl-1,4-benzoquinone (DTBBQ) based on similarity index with reference compounds available in the mass spectra library, NIST. Structure of the pure compound was also elucidated by 1H and 13C nuclear magnetic resonance spectra. The compound DTBBQ showed 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity with IC50 value of 0.6 μg/mL. DTBBQ also showed antimicrobial activity with a zone of inhibition of 21 mm against Bacillus cereus. The results of the present study showed that Streptomyces sp. VITVSK1 could be a promising source for the production of biologically active quinone-based pigments.

**Mario Soccio, Daniela Trono, Maura N. Laus, Donato Pastore. An improved spectrophotometric phospholipase A*2* assay using 1-palmitoyl-2-linoleoyl-*sn*-glycero-3-phosphatidylcholine as substrate and lipoxygenase as coupled enzyme. J. Korean Soc. Appl. Biol. Chem. 56(4):369-376**

An improved spectrophotometric assay of phospholipase A2 (PLA2) activity based on the coupled PLA2/lipoxygenase (LOX) reactions using 1-palmitoyl-2-linoleoyl-sn-glycero-3-phosphatidylcholine (PCLIN) as substrate is reported. The PLA2-mediated release of free linoleate is continuously monitored by following the absorbance increase at 234 nm caused by its conversion into the conjugated diene hydroperoxide catalyzed by the coupled soybean LOX-1 reaction. The new protocol includes the use of Tween 20 (3 μL/μmol phospholipid) as surfactant and of ethanol (15 μL/mL reaction mixture), that ensure clearness of reaction mixture and linear increase of absorbance in the course of reaction. This method was tested on a purified secretory PLA2 from honey bee venom (HBV-PLA2). The enzyme did not discriminate among PCLIN, phosphatidylcholine, and phosphatidylethanolamine, but showed the highest rate using 1,2-dilinoleoyl-sn-glycero-3-phosphatidylcholine (PCDILIN). Nevertheless, the use of PCDILIN is not recommended, as it may induce an overestimation of enzyme activity, because not only the free linoleate, but also the reaction product 1-linoleoyl-lysophosphatidylcholine, are known to be oxidized by LOX. HBV-PLA2 showed maximal activity at pH 9.0, hyperbolic kinetics (Km, 74.2±2.9 μM; Vmax, 827±7 μmol/min/mg protein) and competitive inhibition (Ki about 5 μM) by palmityl trifluoromethyl ketone, a classical PLA2 inhibitor. Interestingly, the HBV-PLA2/soybean LOX-1 coupled reactions also allow an accurate assay of PCLIN concentration. In the whole, these results demonstrate that this improved PLA2/LOX assay allows a very accurate, simple, and rapid measurement of enzyme activity and substrate concentration.

**Mi-Jeong Jeong, DongWon Bae, Hanhong Bae, Soo In Lee, Jin A. Kim, Sung Chul Shin, Sung Han Park, Soo-Chul Park. Inhibition of *Botrytis cinerea* spore germination and mycelia growth by frequency-specific sound. J. Korean Soc. Appl. Biol. Chem. 56(4):377-382**

The effect of sound waves on mycelial growth of Botrytis cinerea was investigated to explore whether frequency-specific sound could be used as a practical alternative to chemical fungicides to control plant diseases. The fungus was exposed to wave frequencies ranging from 1 to 5 kHz, and then observed using light and scanning electron microscopy to assess changes in several physiological and morphological aspects. Of the frequencies tested, 5 kHz sound wave significantly inhibited mycelial growth and spore germination. Furthermore, morphological changes, including low mycelial density, swollen mycelial tips, and irregular mycelial surfaces, were observed. Most internal hyphae were empty, and the ends of hyphae were significantly thinner or swollen. These observations suggest that 5 kHz sound waves create stressful growth conditions for the fungus, which leads to the inhibition of mycelia growth and spore germination. It is possible that sound wave treatment could represent an environmentally-friendly alternative to chemical fungicides. These results broaden our knowledge regarding the effective management of noxious nectrotrophic fungal pathogens by a nonchemical approach.

**Young Min Kang, Min Geun Kim, Han Dae Yun, Kye Man Cho. Construction and expression of a novel *Paenibacillus polymyxa* GS01 bifunctional *xyn*43A-*lin*16A gene through overlap extension PCR. J. Korean Soc. Appl. Biol. Chem. 56(4):383-389**

A shotgun method was adopted to clone the β-xylanase and lichenase genes from a genomic library of a Paenibacillus polymyxa GS01 genome library. Also, a fusion enzyme, Xyn3A-Lin16A, was designed by overlap extension polymerase chain reaction (PCR). The cloned Xyn3A and Lin16A proteins were successfully expressed and exhibited both xylanase and lichenase activities. The xyn43A and lin16A gene amplicons were 1,917 bp and 714 bp in size and encoded proteins of 635 and 238 amino acids, respectively. The Xyn43A and Lin16A gene products showed predicted molecular masses of 65 and 24 kDa with respective calculated pIs of 5.97 and 5.77, respectively. Furthermore, the fusion enzyme gene, Xyn43A-Lin16A, was 4,466 bp in length and encoded a protein of 847 amino acids, with apparent molecular mass of 89 kDa and a calculated pI of 5.93. This fusion enzyme showed optimum activity at pH 6.0–7.0 and 50°C. Thus, the xyn43A and lin16A genes from P. polymyxa GS01were able to exist in tandem, and recombinant DNA technologies can be used to improve enzyme productivity. Therefore, the development of functional fusion enzymes (xylanase-lichenase) using recombinant DNA technologies may lead to further improvements and their successful enzyme engineering in industrial application.

**Su Jeoung Suh, Seong-Hun Lee, Dong-Hoon Lee, In-Jung Kim. Transcriptome analysis of a spontaneous reddish mutant in Miyagawa Wase Satsuma mandarin. J. Korean Soc. Appl. Biol. Chem. 56(4):391-399**

Color is one of the main characteristics determining the fruit quality of Citrus. A spontaneous mutant of Miyagawa Wase Satsuma mandarin (Citrus unshiu Marc.) was selected for its reddish coloration. At the start of ripening, color development of the mutant fruit was faster than that in wild-type fruit. At the mature stage, the intensity of red color in the peel was higher in the mutant without other changes in fruit characteristics. To understand the molecular basis of the mutant phenotype, microarray analysis was performed to observe genome-wide transcriptomic alterations in the mutant compared to the wild-type fruit. In the mutant, the expression levels of 582 genes were altered by more than 2-fold (p <0.05). Up-regulated genes were predominantly classified as genes involved in metabolism, cellular processing, and signaling. The expression levels of enzymes involved in carotenoid and flavonoid metabolisms, which are responsible for pigmentation in plants, were increased in the mutant, whereas enzymes involved in carotenoid degradation also were up-regulated. Confirming the microarray results, real-time reverse transcription-polymerase chain reaction data showed that expression of genes for carotenoid and flavonoid metabolism was strongly increased in the mutant. These results suggest that the changes of gene expression involved in carotenoid and/or flavonoid metabolism could responsible for the red-coloration in mutant.

**Hyun Woo Sim, MiJa Jung, Yong Kweon Cho. Purification and characterization of protocatechuate 3,4-dioxygenase from *Pseudomonas pseudoalcaligenes* KF707. J. Korean Soc. Appl. Biol. Chem. 56(4):401-408**

Protocatechuate 3,4-dioxygenase was isolated and characterized from Pseudomonas pseudoalcaligenes KF707 for the purpose of developing a new anti-browning agent. The protocatechuate 3,4-dioxygenase from Pseudomonas pseudoalcaligenes KF707 was purified 296.8-fold, and showed specific activity of 121.7 U/mg. Based on the SDS-polyacrylamide and gel permeation chromatography, the molecular weight of protocatechuate 3,4-dioxygenase was 189.9 kDa and was composed of 3 αβ protomers, with molecular weights of 29.0 kDa of α subunit and 34.3 kDa of â subunit. The optimal pH and temperature were 7.5 and 38°C, respectively. Km values of catechol, protocatechuate, gallate, p-cresol, caffeic acid, catechin, L-DOPA, 4-methylcatechol and pyrogallol were 14, 17, 2, 10, 12, 20, 30, 21 and 3 μM, and the Vmax/Km (mim−1) values were 0.052, 3.06, 0.35, 0.01, 0.03, 0.02, 0.006, 0.008 and 0.11, respectively. This indicates that the enzyme is active on a wide range of phenyl compounds, in contrast to the high specificity of similar enzymes from other sources. Our data also show that the turnover number of protocatechuate 3,4-dioxygenase from Pseudomonas pseudoalcaligenes KF707 is 68 s−1, which is much higher than the known values from other sources.

**Leila Arab, Ali Akbar Ehsanpour, Nam Soo Jwa. Co-treatment effect of triadimefon and salt stress on antioxidant responses, NHX1 and LEA expression in two alfalfa cultivars (*Medicago sativa* L.) under *in vitro* culture. J. Korean Soc. Appl. Biol. Chem. 56(4):409-417**

This study was carried out to investigate the possibility of using Triadimefon as a plant growth regulator and salt stress protectant in order to decrease the adverse effects of salt stress. Two Medicago cultivars including Hamedani and Yazdi were treated with 0, 2 mg/L triadimefon (TRD) and 0, 100, and 140 mM NaCl. Salt stress increased Na+, ascorbic acid (AA), reduced glutathione (GSH), reactive oxygen species and phenol contents and activity of ascorbate peroxidase (APX), and glutathione reductase (GR), whereas decreased the K+ content and the activity of polyphenol oxidase (PPO) in both cultivars. When plants were treated with TRD and NaCl, they accumulated less Na+, K+, and ROS. Co-treatment of NaCl and TRD in both cultivars increased AA, GSH, and phenol contents, and the activities of APX and GR, whereas reduced PPO activity. Our results also showed that LEA gene was up-regulated by salt stress. TRD treatment resulted in down-regulation of this gene. Sodium/hydrogen exchanger gene was not affected by either salt or TRD treatments.

**Tae Jin Kim, Dong Yeol Choi, Ki-Hong Yoon, Keehyuk Kim, Seung Ju Lee. Application of mixture rule to determine arrhenius activation energy of time temperature integrator using mixture of laccase from *Pleurotus ostreatus* and PEGylated laccase from *Trametes versicolor.* J. Korean Soc. Appl. Biol. Chem. 56(4):419-425**

Two isoenzyme mixture system was developed to freely adjust the Arrhenius activation energy (Ea), which is one of the most important parameters to design a reliable time temperature integrators (TTIs). We hypothesized that the apparent Ea of a mixture of two isozymes would be expressed in a simple linear relationship with the ratio of the mixture, although it could be expressed with a rather complicate equation. To prove our hypothesis, laccase from Pleurotus ostreatus (Ea =27.06 kJ/mol) and PEGylated laccase from Trametes versicolor (Ea =50.35 kJ/mol) were used to prepare enzyme mixtures with ratios of 0, 0.25, 0.5, 0.75, and 1.0. The enzyme activity was determined by the increase of absorbance of 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) incubated at 5–30°C, pH 5.0, and Ea for each enzyme mixture was determined to be in the range of 27.06–50.35 kJ/mol. Relationship between Ea and a ratio of the enzyme mixture not only turned out to be linear, but also was well fitted to the linear mixture rule. This newly found linear dependency is much simpler than kinetically derived one, presumably because microscopic reaction paths and thermodynamic parameters were combined and cancelled out, resulting in linearity. This finding is important in that a mixture of two enzymes with a proper ratio determined from the simple linear mixture rule can customize Ea of an enzymatic TTI. This easier and convenient method can offer a practical and reliable way to adjust Ea of an enzymatic TTI on demand.

**Satheesh Kumar Gudi, Chandrasekhar Gurramkonda, Gulam Rather, Muniramanna Gari Subohsh Chandra, Usha Kiranmayi Mangamuri, Shdhakar Podha, Yong-Lark Choi. Glucoamylase from a newly isolated *Aspergillus niger* FME: Detergent-Mediated production, purification, and characterization. J. Korean Soc. Appl. Biol. Chem. 56(4):427-433**

Glucoamylase (EC 3.2.1.3) is an important group of enzymes in starch processing, also referred to as amyloglucosidases, which are exo-acting amylases that release glucose from the nonreducing end of starch and related oligosaccharides. The glucoamylase newly isolated from the Aspergillus niger FME) was reported for the first time. This enzyme was produced by detergent-mediated release and purified to ∼9.11 fold using Sephadex-G 100 and ion-exchange chromatography. Molecular mass of the glucoamylase was ∼36 kDa as determined by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). The product of starch hydrolysis, analysed by thin-layer chromatography, showed the presence of glucose. The optimum pH and temperature for glucoamylase activity was 5.0 and 45°C, respectively. The Km and Vmax values of the enzyme were also determined using soluble starch as substrate as 94 μg/mL and 39.02 U/mg, respectively. Moreover, glucoamylase was slightly activated by presence of Na and K ions and 10–20% inhibition was observed in presence of Zn2+, Sn2+, Mg2+, Ni2+, Mn2+, and almost 80% with Cu2+ ions, whereas the presence of ethylene diamine tetra acetic acid (EDTA) did not show significant inhibition. Glucoamylase, also assayed for surfactant property, shows significant surfactant tolerance at high concentrations of detergent and can retain 90% of its activity. Finally, secondary structure analysis of glucoamylase by circular dichroism spectroscopy showed the presence of 48% α-helix, 11% β-sheet, and 41% random structure.

**In-Wook Hwang, Shin-Kyo Chung, Moon-Cheol Jeong, Hun-Sik Chung, Hu-Zhe Zheng. Optimization of enzymatic hydrolysis of persimmon peels for vinegar fermentation. J. Korean Soc. Appl. Biol. Chem. 56(4):435-440**

Response surface methodology (RSM) was used to determine the treatment conditions of optimal enzymatic hydrolysis for vinegar preparation from persimmon peel. Persimmon peel was hydrolyzed with different concentrations of Viscozyme L (0–4%) at different temperatures (40–60°C) for different lengths of time (2–10 h) followed by vinegar fermentation. Reducing sugar and soluble solids of the hydrolyzed juice were significantly affected by the hydrolysis conditions. Optimal condition was obtained with the enzyme concentration of 2.38 g/100 mL, reaction temperature of 49.19°C, and reaction time of 6.32 h. The titratable acidity of vinegar prepared from the juice hydrolyzed under the optimized condition increased by 276% (4.25 g/100 g). Acetic acid, citric acid, oxalic acid, and succinic acid were identified in the vinegar. Results suggest that the enzymatic hydrolysis pretreatment could be used for increasing the yield of the vinegar fermentation.

**Peck Loo Kiew, Mat Don Mashitah. Isolation and characterization of collagen from the skin of Malaysian catfish (Hybrid *Clarias* sp.). J. Korean Soc. Appl. Biol. Chem. 56(4):441-450**

Acid soluble collagen (ASC) and pepsin soluble collagen (PSC) were isolated from the skin of hybrid Clarias sp. with the yields of 18.11±0.32 and 26.69±0.54% (wet weight basis), respectively. Both collagens were characterized as type I collagen, containing α1 and α2 chains. Presence of high molecular weight crosslinks were observed in the gel electrophoresis of both collagens. Fourier transform infrared spectra of both collagens were almost similar, suggesting that pepsin hydrolysis did not disrupt the triple helical structure. The amino acid analysis showed glycine was the most abundant, with 207/1000 and 223/1000 residues present in ASC and PSC, respectively. The amounts of imino acids were 185/1000 residues for both. Thermal denaturation temperatures were determined to be 31.5 and 31.0°C, respectively. Both collagens exhibited high solubility in acidic pH (1–5) and below 4% (w/v) NaCl concentration.

**Hyun-Joo Chang, Young Sup Kim, Shi Yong Ryu, Hyang Sook Chun. Screening of various sources of phytochemicals for neuroprotective activity against oxygen-glucose deprivation *in vitro.* J. Korean Soc. Appl. Biol. Chem. 56(4):451-455**

Neuroprotective activities of 176 phytochemicals were investigated against oxygen-glucose deprivation in vitro using primary cortical neuron culture. Diterpenes (taxol and taxol C) were the most potent neuroprotective compounds. EC50 of taxol and taxol C were 0.402 and 0.452 μM, respectively. This result supports the use of an in vitro model as initial screening for neuroprotective candidates, which warrants further testing in animal models.

**Dong Young Rhyu, Si Hyung Park. Characterization of alkyl thiosulfinate in *Allium hookeri* root using HPLC-ESI-MS. J. Korean Soc. Appl. Biol. Chem. 56(4):457-459**

Allicin produced by alliinase system of Allium hookeri was evaluated via high performance liquid chromatography (HPLC). Allicin contents of A. hookeri were 56.6±3.5 μg per g of fresh root and 12.7±3.2 μg per g of fresh stem. These values were relatively low as compared with garlic. HPLC-electrospray ionization-mass spectrometry analyses showed A. hookeri root extract contained ten alkyl thiosulfinates, and the chemical structures were characterized by MS/MS analyses.

**Mahtab Ahmad, Deok Hyun Moon, Mahmoud Wazne, Hee Joung Kim, Young Han Lee, Yong Sik Ok. Effects of natural and calcined oyster shells on antimony solubility in shooting range soil. J. Korean Soc. Appl. Biol. Chem. 56(4):461-464**

Waste oyster shells (OS) and calcined oyster shells (COS) were used to treat metal-contaminated shooting range soil, where antimony (Sb) leachability was assessed. Changes in soil pH induced by the amendments strongly influenced Sb leachability. Sb was immobilized by COS most likely due to calcium antimonate precipitation. This is the first time to our knowledge to report that COS can effectively immobilize Sb in the soil.

**Hoon Choi, Ji-Youn Byoun, Jeong-Han Kim. Determination of reentry interval for cucumber harvesters in greenhouse after application of insecticide methidathion. J. Korean Soc. Appl. Biol. Chem. 56(4):465-467**

Determination of reentry interval for harvesters after application of insecticide methidathion on cucumber in greenhouse was performed. Dislodgeable foliar residue of methidathion ranged from 12.1∼222.5 ng/cm2 for 7 days after application. First-order rate constant for methidathion residue on foliage was −0.4915, and half-life was 1.4 days. The reentry interval (REI) without personal protective clothing or equipment was calculated as 44 h (1.8 days), which is not practical, because cucumber is usually harvested everyday during production period due to its fast growing characteristics. However, when harvester wear personal protective clothing or equipment, −69 h (−2.9 days) of REI was determined, indicating they could reenter greenhouse on the day of application. Therefore, harvesters must wear personal protective clothing or equipment for safe harvesting activity in cucumber greenhouse on the day of application.

**Yong-ung Kim, Jaehong Han. Steroid 5*α*-reductase inhibition by polymethoxyflavones. J. Korean Soc. Appl. Biol. Chem. 56(4):469-471**

Steroid 5α-reductase inhibition was studied using eleven polymethoxyflavones (PMFs). Homologous eleven PMFs showed wide range of steroid 5α-reductase inhibitory effects. Among the tested PMFs, 5-hydroxy-7,4′-dimethoxyflavone (5) was found to be the most potent inhibitor of steroid 5α-reductase with the IC50 of 20 μM. These results showed PMFs could be used as a nonsteroidal steroid 5α-reductase for the treatment of benign prostatic hyperplasia.

**Xue Jiang, Il-Hwan Oh, Seul-Gi Lee, Hyung-Kyoon Choi. The application of metabolomics to processed traditional Chinese medicine. J. Korean Soc. Appl. Biol. Chem. 56(5):475-481**

Processing technologies, which are required in the production of traditional Chinese medicine (TCM), has garnered attention in recent years. To address challenges associated with processed TCM and to promote its development in academia and industries, the application of metabolomics was introduced in this review, which primarily focuses on exploring TCM theories, identification of discovered compounds, and the evaluation and quality control of TCM through metabolomics. Thus metabolomics could be a powerful method for the TCM processing industry.

**Moo-Hyeog Im. Review of Codex Alimentarius and comparison between the US and Korean food classifications for pesticide residues of the US and Korea. J. Korean Soc. Appl. Biol. Chem. 56(5):483-495**

All countries worldwide are experiencing difficulties in setting maximum residue limits (MRLs) for pesticide residues in food commodities due to prohibitive costs, labor, and other expenses. The Codex Alimentarius (Codex) is actively engaged in revising the classification of food commodities that are grown in small areas; however, setting MRLs for all agricultural commodities has not been effective. Modified food classifications for groups of agricultural commodities were established for setting MRLs of pesticides for each food commodity. Codex accepted various countries’ opinions that the old food classification of commodities can no longer be applied to the present food classifications; therefore, from 2009, Codex started to revise their food classifications. To set pesticide MRLs for agricultural products grown in small fields, groups of agricultural commodities were subdivided, and new food classifications were used. The food classification revised by Codex made it easy to set up group MRLs. After the Codex food classification was revised, jujube and persimmon, which were previously classified as tropical fruits, were grouped as pome fruits and stone fruits based on the opinion of the Korea Food & Drug Administration (KFDA). In addition, KFDA submitted more comments on the classification of various vegetables. As a result, Korean vegetables were included in the food classification by Codex. The current Codex food classifications in Korea still have not adopted a group-specific subdivision system that is already used in Codex and the US internationally harmonized food classification revisions by Codex might resolve the difficulty of setting up pesticide MRLs for agricultural commodities such as vegetables in Korea. Consequently, food classifications in Korea, which are in harmony with the Codex food classification, will be of great help in setting the group MRLs for the minor crops of Korea.

**amasamy Rajesh Kumar, Bong Ju Park, Jae Young Cho. Application and environmental risks of livestock manure. J. Korean Soc. Appl. Biol. Chem. 56(5):497-503**

Over the past few decades, livestock production has undergone an industrial revolution, resulting in the large-scale generation of livestock manure. Livestock manure has many beneficial nutrients, which can improve agricultural crop production, and is an organic alternative to chemical fertilizers. Livestock manure requires proper treatment before application to agricultural land, because it contains toxic heavy metals and pathogenic microorganisms. When improperly treated, stored or used, livestock manure can pollute rivers, soil ecosystems, and underground drinking water, thereby affecting all living organisms nearby. In this article, we illustrate the land applications and environmental risks associated with the use of livestock manure.

**K. K. I. U. Arunakumara, Buddhi Charana Walpola, Min-Ho Yoon. Alleviation of phyto-toxicity of copper on agricultural plants. J. Korean Soc. Appl. Biol. Chem. 56(5):505-517**

Copper (Cu), a redox-active transition metal, is known to be involved in protein metabolism, photosynthetic and respiratory electron transport, cell wall metabolism, antioxidant activity, nitrogen fixation, ion metabolization, and hormone perception, among others in plants. Though Cu has been listed among the essential elements, it could potentially result in complete inhibition of plant growth and development at excess concentrations. Measures available for alleviating Cu toxicity in plants are discussed in the present paper. Exogenous application of nitric oxide through up-regulating the components of antioxidant defense system [catalase (CAT-EC 1.11.1.6), peroxidase (POD-EC 1.11.1.7), superoxide dismutase (SOD-EC 1.15.1.1), and ascorbate peroxidase (APX-EC 1.11.1.11) activities] and stimulating the enzyme P5CS (D1-pyrroline-5-carboxylate synthetase), which catalyzes proline biosynthesis, has been proved to stand against the adverse impacts of Cu toxicity. Addition of cations (such as Ca2+ and Mg2+) through stimulating site-specific competition for metal ions could also prevent excess accumulation of Cu in cell interior. Silicon application, through nutrient balancing and physically blocking the apoplastic bypass flow has also been recognized to be effective in alleviating Cu toxicity. Addition of organic amendments and use of arbuscular mycorrhizal fungi as soil inoculants have also proved successful in amelioration of Cucontaminated soils. Though molecular and physiological mechanisms associated with Cu toxicity have been substantially investigated, information on the regulation of the expression of stress-related genes in key agricultural plant species is still lacking. Additional research efforts focusing at field validation of the toxicity alleviation methods are also equally important.

**Sae-Kwang Ku, In-Chul Lee, Jong-Sup Bae. Inhibitory effects of purpurogallin on the endothelial protein C receptor shedding *in vitro* and *in vivo.* J. Korean Soc. Appl. Biol. Chem. 56(5):519-524**

Endothelial cell protein C receptor (EPCR) plays important roles in the regulation of blood coagulation and inflammation. Activity of EPCR is markedly changed by ectodomain cleavage and released as soluble protein (sEPCR). EPCR can be shed from the cell surface, and this is mediated by tumor necrosis factor-α converting enzyme (TACE). Purpurogallin (PPG) plays an important role in inhibiting glutathione S-transferase and xanthine oxidase as well as effective in the cell protection of several cell types. Here, we investigated the effects of PPG on phorbol-12-myristate 13-acetate (PMA), tumor necrosis factor (TNF)-α, interleukin (IL)-1β, and on cecal ligation and puncture (CLP)-mediated EPCR shedding and underlying mechanisms. Human umbilical vein endothelial cells pretreated with PPG (0, 5, 10, 20 or 50 μg/mL) for 6 h and exposed to PMA (1 μM) for 1 h, and CLP-operated mice were administrated with PPG. Data showed that treatment with PPG resulted in potent inhibition of PMA, TNF-α, IL-1β, and CLP-induced EPCR shedding by suppression of TACE expression. In addition, PPG reduced PMA-stimulated phosphorylation of p38, extracellular regulated kinases 1/2, and c-Jun N-terminal kinase. These results suggest the potential for use of PPG as an anti-sEPCR shedding reagent against PMA and CLP-mediated EPCR shedding.

**Bong-Gyu Kim, Joong-Hoon Ahn. Characterization of uridine diphosphate-sugar pyrophosphorylase from *Populus deltoids.* J. Korean Soc. Appl. Biol. Chem. 56(5):525-531**

Nucleotide sugars serve as sugar donors for the biosynthesis of various cell components including cell wall, glycoproteins, and small molecules. Among them, uridine diphosphate (UDP)-glucose is one of main nucleotide sugars that serve as a substrate for the synthesis of other UDP-sugars. UDP-sugar pyrophosphorylase (USPase) mediates the formation of UDP-glucose from uridine triphosphate (UTP) and glucose-1-phosphate. A USPase, PdUSPase was cloned from Populus deltoids and expressed in Escherichia coli as glutathione Stransferase fusion protein. The purified recombinant PdUSPase catalyzed the reaction for the formation of UDP-glucose from glucose-1-phosphate and UTP, and for the formation of UDP-galactose from galactose-1-phosphate and UTP. However, the enzyme did not show any activity toward mannose-1-phosphate and UTP. These results indicate that PdUSPase belonging in UGPase A in phylogenetic analysis is the first UDP-glucose synthesizing enzyme showing a discrepancy between phylogenetic analysis and substrate range. E. coli complementation was also carried out to confirm the function of PdUSPase using E. coligalU mutant, which was mutated in UTP glucose-1-phosphate uridyltransferase. The galU mutant was transformed with the PdUGTase gene and a flavonoid glucosyl-transferase gene, AtUGT78D2. The resulting transformant was able to convert quercetin into quercetin 3-O-glucose similarly to that by the wild type E. coli strain harboring AtUGT78D2. These results indicated that PdUSPase catalyzed the formation of UDP-glucose from UTP and glucose-1-phosphate.

**Samira Jebahi, Hassane Oudadesse, Jiheun Elleuch, Slim Tounsi, Hassib Keskes, Pascal pellen,**

**Tarek Rebai, Abdelfatteh El Feki, Hafed El Feki. The potential restorative effects of strontium-doped bioactive glass on bone microarchitecture after estrogen-deficieny induced osteoporosis: Physicochemical and histomorphometric analyses. J. Korean Soc. Appl. Biol. Chem. 56(5):533-540**

Strontium (Sr) compounds have become increasingly popular in the field of osteoporosis treatment. However, the quality of new bone after implantation of strontium-containing bioceramics has yet to be investigated. In the present study, the newly formed bone tissue around strontium-doped bioactive glass (BG-Sr) implants was characterized. BG-Sr was implanted in the femoral condyl of ovariectomised rats (OVX). The resected bone was prepared for analysis using several physico-chemical and biological assays such as Fourier transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy, energy-dispersive X-ray, and histomorphometry. BG-Sr biomaterial favored calcium phosphate layer integration on the surface of the glass and offered better bioactivity. Moreover, the histomorphometric analysis demonstrated that BV/TV, N. Ob were significantly higher in BG-Sr treated rats groups than those of BG groups. However, Ob. S/BS, and OV/BV were significantly lower in BG-Sr treated rats groups than those of BG groups. The (Oc.S/BS) was significantly decreased in BG-Sr groups, when compared with that of BG rat groups. On the other hand, the MS/BS had not significantly decreased in the BG-Sr treated rats groups when compared with that of BG groups, however; it was significantly higher when compared with control and OVX groups. These findings suggest that BG-Sr can be used as an inhibitory therapeutic potential of osteoporosis by delivering strontium to stimulate new bone remodeling.

**Jin Kyu Kim, Joa Sub Oh, Jin-Koo Lee. Antinociceptive effect of glyasperin F isolated from *Glycyrrhiza inflata* in mice. J. Korean Soc. Appl. Biol. Chem. 56(5):541-545**

Antinociceptive effect of glyasperin F isolated from Glycyrrhiza inflata extract (GIE) in ICR mice was studied. Oral administration of GIE (1–100 mg/kg) caused a dose-dependent reduction in acetic acid-induced writhing responses. To identify the active antinociceptive compound from the GIE, sub-fractions were obtained from the EtOAc layer of GIE by using a medium pressure liquid chromatography. From the sub-fractions obtained, the sub-fraction, which, when administered orally (10 mg/kg) showed an antinociceptive effect in both the writhing test and second phase of the formalin test was identified as glyasperin F using NMR and MS analyses. Finally, the antinociceptive effect of glyasperin F in mouse models of pain was confirmed. Orally administered glyasperin F (0.1–10mg/kg) showed a dose-dependent antinociceptive effect in both the writhing test and second phase of the formalin test. Taken together, glyasperin F isolated from the GIE may be used as a leading compound for further studies on pain and as a new drug derived from natural products for pain therapy.

**Jeong-Yong Cho, Kang-Deok Lee, Sun-Young Park, Won Chul Jeong, Jae-Hak Moon, Kyung-Sik Ham. Isolation and identification of *α*-glucosidase inhibitors from the stem bark of the nutgall tree (*Rhus javanica* Linné). J. Korean Soc. Appl. Biol. Chem. 56(5):547-552**

Ethyl acetate (EtOAc) layer obtained after the solvent fractionation of hot water extracts from nutgall tree (Rhus javanica) stem bark showed higher α-glucosidase inhibition activity than other layers. A novel acetophenone glucoside (4) and six known phenolic compounds were isolated from the EtOAc layer. The structure of 4 was determined to be 3,4,5-trihydroxyacetophenone 4-O-β-d-glucopyranoside. The six known compounds were identified as gallic acid (1), 5-methylresorcinol (2), methylgallate (3), 3-hydroxy-5-methylphenol 1-O-β-d-(6′-galloyl)glucopyranoside (5), scopoletin (6), and phlorizin (7). Their chemical structures were determined by electrospray ionization mass spectrometry and nuclear magnetic resonance analyses. Compound 5 was newly identified from this plant. Compounds 6 and 7 showed significantly higher α-glucosidase inhibition activity than other compounds.

**Dongbum Kim, Younghee Lee, Hyung-Joo Kwon. Expression of IFN-*γ* induced by CpG-DNA stimulation in a human myeloid leukemia cell line KG-1. J. Korean Soc. Appl. Biol. Chem. 56(5):553-558**

CpG-DNA has potent immunostimulatory effects to induce expression of cytokines and chemokines in macrophages, dendritic cells, and B cells. KG-1 is a human myeloid leukemia cell line used as an in vitro model system for dendritic cell differentiation. Here, we investigated effect of CpG-DNA on IFN-γ expression in KG-1 cells. Based on the mRNA and protein expression, stimulation of KG-1 cells with the phosphorothioated form of CpG-DNA induced expression of IFN-γ. The IFN-γ promoter includes one NF-κB binding site and two AP-1 binding sites. Induction of IFN-γ was markedly reduced in the presence of NF-κB, p38, and MEK1 inhibitors. Furthermore, AP-1 was found to interact with both of the two binding sites in the IFN-γ promoter. Therefore, we conclude that CpG-DNA induced activation of NF-κB and AP-1 leads to induction of IFN-γ, which may further contribute to immunostimulatory activity of CpG-DNA.

**Yong-Joo Kim, Chang-Hyun Choi. The analysis of paddy soils in Korea using visible-near infrared spectroscopy for development of real-time soil measurement system. J. Korean Soc. Appl. Biol. Chem. 56(5):559-565**

Precision farming aims at reducing environmental risks and increasing productivity. Soils are multi-functional media, in which air, water and biota occur together to form an essential part of the landscape, with a fundamental role in the environment. The requirement for herbicides and fertilizers can vary within a field in response to spatial differences in soil properties. Near infrared (NIR) spectroscopy is widely used today as a nondestructive analytical technique, which is capable of determining a number of physio-chemical parameters. The objective of this study was to develop optimal models for predicting chemical properties of paddy soils by visible and NIR reflectance spectra. Reflectance spectra, moisture contents, pH, total nitrogen, organic matter, available phosphate, exchangeable potassium, ex. calcium, ex. magnesium, ex. sodium, iron, manganese, zinc, and copper of soil samples were measured. The reflectance spectra were measured in the wavelength range of 400–2,500 nm with 2-nm intervals. The method of moving window partial least square (MWPLS) analysis, which is a wavelength interval selection method for multi-component spectra analysis, was used to determine the soil properties. MWPLS models showed the possibility to predict chemical properties of soil samples in the wavelength range of 1,000–2,500 nm, offering the possibility of considerable cost savings and increased efficiency over the conventional analysis method.

**Sunyi Lee, Sora Han, Jeong Su Park, Ae Lee Jeong, Seung Hyun Jung, Kang-Duk Choi, Tae-Young Han, Il-Young Han, Young Yang. Herb mixture C5E aggravates doxorubicin-induced apoptosis of human breast cancer cell lines. J. Korean Soc. Appl. Biol. Chem. 56(5):567-573**

A number of extracts from Asian traditional medicinal herbs have been successfully used as therapeutic agents against cancers. In this study we assessed the effect of C5E on the proliferation inhibition and apoptosis of breast cancer cell lines. C5E is an ethanol extract from traditional Asian medicinal plants which have anticancer activity. Nonetheless, little is known about the underlying mechanism. Thus, we studied the mechanism of C5E-induced cell death in the human breast cancer cell line MDA-MB-231 and MCF7 cells. The cell survival rate was reduced in a concentration- and time-dependent manner, as assessed by direct cell counting. After incubation for 48 h, typical apoptotic morphological changes were observed by microscope. To determine the synergetic effect with doxorubicin, we co-treated C5E with doxorubicin in breast cancer cells, and flow cytometry revealed that co-treatment obviously enhanced sub-G1 arrest and apoptosis in MDA-MB-231 and MCF7 cells. Furthermore, we showed that pro-apoptotic marker cleaved PARP was synergistically increased with the combined treatment of doxorubicin and C5E in MDAMB-231, but not in MCF-7. These results suggest that the effect of combined treatment of C5E with doxorubicin on sub-G1 arrest and apoptosis in breast cancer cells could be exerted by the different mechanism and its potential use as a therapeutic agent will be helpful in treatment for breast cancer.

**Jun-Hyeok Kim, Ngoc Trinh Nguyen, Vu Van Kien, Nguyen Hoai Nguyen, Young-Seok Jang, Hojoung Lee, Suk-Whan Hong. Induction of oxidative stress by overexpression of *α*-zein cDNA with mutation in signal peptide in *Arabidopsis.* J. Korean Soc. Appl. Biol. Chem. 56(5):575-581**

Defective endosperm (De\*)-B30 is a dominant maize mutation in the gene that encodes the storage protein, α-zein protein. The De\*-B30 mutation results in a defective signal peptide in a 19-kD α-zein protein, which triggers endoplasmic reticulum (ER) stress, leading to up-regulation of genes associated with the unfolded protein response. To extend our knowledge of the physiological responses to constitutive ER stress in plants, transgenic Arabidopsis plants were constructed, in which De\*-B30 transcripts were constitutively expressed under the control of the CaMV 35S promoter. Transgenic plants exhibited pale green leaves and growth retardation during the early vegetative stage. In addition, the growth rate of hypocotyl elongation was depressed in dark-grown transgenic seedlings. However, RNA blot analyses revealed no induction of the ER stress-inducible genes, including AtBiP1, AtCNX1, and AtCRT1 in transgenic Arabidopsis plants. Even though transgenic plants also were revealed to retain wild-type level of tunicamycin sensitivity, they showed an increase in hydrogen peroxide production. Higher levels of AtGST1 gene expression in transgenic plants were revealed. These findings suggest that reactive oxygen species are involved in the response to constitutive ER stress in Arabidopsis.

**Jin-Hyeob Kwak, Kwang-Seung Lee, Sang-Sun Lim, Miwa Matsushima, Kye-Han Lee, Sang-Mo Lee, Woo-Jung Choi. Historical responses of *Quercus variabilis* growth to environmental changes in Southern Korea: Evidence from tree ring width and *δ*13C. J. Korean Soc. Appl. Biol. Chem. 56(5):583-590**

Historical growth response of Quercus variabilis, which is the most important deciduous timber species in Korea, was investigated using the width and C isotope ratio (13C/12C denoted as δ13C) of the annual ring from 1975 to 2007. Tree disks were collected from three Q. variabilis trees with different growth statuses from a site in the Mt. Naejang area, and analyzed for annual ring width and δ13C. Basal area increment (BAI) of the annual ring was calculated from the width data, and carbon isotope discrimination (Δ) was calculated using δ13C. The intercorrelations among BAI, Δ, and environmental variables were explored. The BAI was positively (p <0.001) correlated with atmospheric CO2 concentration ([CO2]), reflecting increased net photosynthesis with [CO2], whereas the negative correlations of BAI with either NO2 (p <0.05) or O3 (p <0.05) concentrations suggested that atmospheric pollution might have restricted tree growth to some degree. The Δ was positively correlated with both temperature (p <0.05) and [CO2] (p <0.001), and BAI was also positively correlated with Δ (p <0.001). However, precipitation was correlated with neither BAI nor Δ, indicating that the precipitation amount is sufficient for tree growth in the study site. Such relationships suggest that stomatal rather than non-stomatal control is the predominant mechanism of photosynthetic acclimation of Q. variabilis under changing environmental conditions in the study site where water availability is not limited.

**Ju-Hyun Jeon, Min-Gi Kim, Hoi-Seon Lee. Insecticidal activities of *Ruta chalepensis* leavesisolated constituent and structure-relationships of its analogues against *Sitophilus oryzae.* J. Korean Soc. Appl. Biol. Chem. 56(5):591-596**

The insecticidal activities of active component isolated from Ruta chalepensis L. (Rutales: Rutaceae) leaves and its derivatives were examined using fumigant and contact toxicity methods against rice weevil, Sitophilus oryaze L. (Coleoptera: Curculionidae) adults. Administering the chloroform fraction of the methanol extract resulted in 87.7% mortality at 1.02 mg/cm2 against S. oryzae adults, using a fumigant method. The insecticidal constituent of R. chalepensis leaves was isolated by chromatographic techniques, and identified as quinoline-4-carbaldehyde (C10H7NO). Based on the LD50 values, the most toxic compound against S. oryzae was quinoline (0.063 mg/cm2), followed by quinoline-4-carbaldehyde (0.084 mg/cm2), and quinoline-3-carbaldehyde (0.173 mg/cm2) using the fumigant method. In the contact method, the most active compound against S. oryzae was quinoline (0.057 mg/cm2), followed by quinoline-4-carbaldehyde (0.065 mg/cm2), and quinoline-3-carbaldehyde (0.092 mg/cm2). Changing the position of aldehyde groups in the quinoline skeleton increases the insecticidal activities against S. oryzae. Furthermore, these results suggest that naturally occurring quinoline-4-carbaldehyde and its derivatives could have potential for managing populations of insect pests affecting stored food products.

**Jae-Woon Jung, Ha-Na Park, Kwang-Sik Yoon, Dong-Ho Choi, Byung-Jin Lim. Event mean concentrations (EMCs) and first flush characteristics of runoff from a public park in Korea. J. Korean Soc. Appl. Biol. Chem. 56(5):597-604**

Characteristics of non-point source (NPS) pollution runoff from a public park in Gwangju, Korea were investigated. Results exhibited the highest pollutant concentrations at the start of the rainfall events due to their build-up and wash off processes. The average event mean concentrations (EMCs) were 27.8, 7.2, 56.3, 7.5, and 0.84 mg/L (range: 4.2–54.8 mg/L) for COD, (0.5–20.8 mg/L) for TOC, (22.3–138.4) for SS, (1.4–18.5 mg/L) for T-N, and (0.17–2.02 mg/L) for T-P, respectively. The study site presented a strong first flush effect for most rainfall events. However, no first flush effect was observed in rainfall events with small rainfall factors (e.g. intensity, amount, and runoff depth). On the other hand, the ratios of total pollution loads discharged by the first 20% of runoff volume were 32% for COD, 34% for TOC, 36% for SS, 42% for T-N, and 50% for T-P. Especially, MFF20 (mass first flush) values of T-N and T-P were larger than those of other pollutants (COD, TOC, SS), indicating that T-N and T-P are easily transported by stormwater runoff from the public park. First flush management of T-N and T-P, therefore, is required for efficient water quality management of the public park.

**Jin Hwan Lee, Byong Won Lee, Balo Kim, Hyun Tae Kim, Jong Min Ko, In-Yeoul Baek, Weon Taek Seo, Young Min Kang, Kye Man Cho. Changes in phenolic compounds (Isoflavones and Phenolic acids) and antioxidant properties in high-protein soybean (*Glycine max* L., cv. Saedanbaek) for different roasting conditions. J. Korean Soc. Appl. Biol. Chem. 56(5):605-612**

Contents of phenolic compound including isoflavones and phenolic acids as well as antioxidant effects in high-protein soybean cultivar “Saedanbaek” were evaluated under different roasting conditions. The roasted soybean exhibited significantly higher antioxidant activity than unroasted soybean in the three antioxidant methods including 2,2-diphenyl-1-picrylhydrazyl, 2,2-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid), and Ferric reducing antioxidant power. In particular, the roasted soybean at 200°C for 15 min showed the highest antioxidant activity in comparison with other conditions. The contents of phenolic compounds, isoflavone aglycones (genistein, daidzein, and glycitein), isoflavone β-glucosides (genistin, daidzin, and glycitin), and phenolic acids increased, whereas isoflavone malonyl-β-glucosides decreased during roasting process. Moreover, total phenolic and flavonoid contents as well as those of isoflavone aglycones, isoflavone-β-glucosides, and phenolic acids increased, leading to a general increase in antioxidant activity after roasting. These results suggest that the roasting soybean extracts could contribute to obtaining natural antioxidants in certain food applications.

**Yu Qian, Guijie Li, Kai Zhu, Peng Sun, Xia Feng, Xin Zhao. Effect of resistant starch on HCl/ethanol-induced gastric injury in rats. J. Korean Soc. Appl. Biol. Chem. 56(5):613-619**

Three types of resistant starch (RS) products were purchased for the evaluation of gastric injury preventive effect in Sprague-Dawley rats. We used an animal model to check for gastric injury preventive activities of these RS products in vivo. RS3 reduced the levels of serum proinflammatory cytokines of IL-6 and TNF-α as compared to those of RS2 and RS4. The gastric secretion volumes from high to low order were control rats, RS2-treated rats, RS4-treated rats, RS3-treated rats, and normal rats, whereas pH levels of gastric juice showed the opposite trend. The gastric injury level was significantly decreased by RS, demonstrating its anti-inflammatory properties, with RS3 showing the best anti-inflammatory effect. Gastric tissues of RS3 group rats showed significantly decreased mRNA and protein expression levels of inflammation-related genes of iNOS, COX-2, TNF-α, and IL-1β compared with the control group, as shown by RT-PCR and Western blot analyses. These results suggest that RS shows a gastric injury preventive effect, with RS3 showing the best inhibitory effect on gastric injury.

**Seong Yeong Kim, Ho Lee. Effects of eating quality on milled rice produced from brown rice with different milling conditions. J. Korean Soc. Appl. Biol. Chem. 56(5):621-629**

This study was conducted to determine the optimal milling condition including moisture content (11, 13, 15, 17, and 19%) and kernel temperature (0, 10, 20, 30, and 40°C) of brown rice to produce milled rice with predominant eating quality, which was examined by a sensory evaluation. Intensity of glossiness and taste on cooked rice decreased with the increase of moisture content and kernel temperature of brown rice, whereas yellow color and off-flavor intensity increased (p <0.001). Quality scores of appearance, flavor, taste, texture, and overall eating quality showed relatively higher value in below kernel temperature 20°C, particularly in moisture content 15 and 17% at kernel temperature 0 and 10°C, whereas ≥15% of moisture content at kernel temperature 40°C showed very low quality scores (p <0.001). Consequently, optimum milling condition of brown rice should be moisture content 15–7% and kernel temperature 0–10°C for the production of milled rice with good eating quality.

**Yeon Woo Song, Sanggyu Park, Somi K. Cho, Dongsoo Koh, Moonjae Cho. Synergistic effect of the novel benzochalcone derivative DK-78 and doxorubicin on MCF7-VN breast cancer stem cells. J. Korean Soc. Appl. Biol. Chem. 56(5):631-635**

Several naturally occurring or synthesized forms of chalcone have been shown to possess multiple biological properties, including antitumor activities. A novel synthetic flavonoid, the benzochalcone derivative DK-78, was administered with the anticancer drug doxorubicin to two breast cancer cell lines (MCF7-VN and MDA-MB-231), and was evaluated for a synergistic cytotoxic effect. DK-78 reduced the expression of mesenchymal marker proteins and reduced cell migration and attachment. Sequential treatment with DK-78 and doxorubicin showed synergistic effects.

**Hyuk Jung, SangJun Moon. Purification, Distribution, and Characterization Activity of Lipase from Oat Seeds (*Avena sativa* L.). J. Korean Soc. Appl. Biol. Chem. 56(6):639-645**

Plant lipases have been chiefly studied as an esterase for hydrolyzation of triacylglycerol (a true lipase), which supplies energy for seed germination. Lipases are widely distributed in plants, animals, insects, and microorganisms. However, recent studies suggest that plant lipases have physiological functions other than triacylglycerol hydrolysis. In the present study, a plant lipase that has enzyme properties distinct from those of a true lipase was purified and characterized from oat seedlings. The lipase was purified 189-fold to a 0.53% purification ratio with high specific activity (34.656 U/mg). Analysis of the protein by Sodium dodecyl sulfate polyacrylamide gel electrophoresis showed a homogenous purified lipase. The lipase had higher enzyme specificity to monoacylglyceride and short chain fatty acids. Synthesis of the lipase was active at an early stage of germination for 6 days and decreased thereafter. Most of the lipase was found in the upper part of the oat seedling excluding the root. Within the young leaves, the lipase is located only in vessels and sieve tubes. However, infection of a pathogen, *Pseudomonas syrinae* pv. *oryza*e, elevated the lipase synthesis. In addition, the lipase had an ability to hydrolyze *E.coli* lipopolysaccharide. These results suggested that oat lipase may play a physiological role in defense against pathogens.

**Won-Sik Choi, Sun-Ho Chang, Jang-Eok Kim, Sung-Eun Lee. Hypolipidemic Effects of Scoparone and Its Coumarin Analogues in Hyperlipidemia Rats Induced by High Fat Diet. J. Korean Soc. Appl. Biol. Chem. 56(6):647-653**

In the present study, 17 coumarins were evaluated for cholesterol-lowering activity in rats fed a high-fat diet. Two statins, atorvastatin and simvastatin, were used as positive controls. Each group consisted of eight rats; weight gain, food intake, and feed efficiency ratio within 4 weeks were determined. Four biochemical parameters (total cholesterol, low-density lipoprotein, high-density

lipoprotein, and total glycerides) were determined in each tested group. Atherogenic index, cardiac risk factor, and liver indexes were also calculated to explain structure-activity relationships of coumarins. With the results of weight gain and food intake, the feed efficiency ratio (FER) was calculated for the 17 coumarins. The positive control groups did not recover FER values to the level of the normal group. The high-fat diet increased concentrations of total cholesterol, low-density lipoprotein, and total glycerides in the control rats as compared to the normal rats, whereas highdensity lipoprotein decreased in the control rats. The two statins and all coumarins lowered cholesterol and increased high-density lipoprotein level to those of the normal rats. 7-Methoxycoumarin was the highest cholesterol-lowering coumarin and showed potent recovery rate of cardiac risk factor, and the atherogenic and liver indices as compared to the normal rats. Structure-activity analyses of coumarins implicated a double bond at C3-C4 and a methoxy group at C7 as being essential for the cholesterol-lowering activity. 7-Methoxycoumarin may partially inhibit the intestinal absorption of cholesterol by interfering with micelle formation.

**Mi Oh, Seon Young Bae, Mi Sook Chung. Mulberry (*Morus alba*) Seed Extract and Its Polyphenol Compounds for Control of Foodborne Viral Surrogates. J. Korean Soc. Appl. Biol. Chem. 56(6):655-660**

Noroviruses are the most frequent cause of foodborne viral gastroenteritis, causing approximately 90% of non-bacterial epidemic outbreaks around the world. Mulberry (*Morus alba*) seeds are by-products of juice and wine industries. Antiviral effects of mulberry seed extract (MAS) on foodborne viral surrogates, feline calicivirus-F9 (FCV-F9), and murine norovirus-1 (MNV-1) were evaluated by plaque assays and reverse transcription polymerase chain reaction. Polyphenol compound analysis using liquid chromatography-mass spectrometry revealed that caffeic acid, 3,4-dihydroxybenzoic acid, rutin, and cyanidin-3-rutinoside were the major compounds of MAS in a decreasing order. Its fraction (MAS-F1) with molecular weight less than 1 kDa, showed a similar composition, except for caffeic acid, a minor component. The maximal antiviral effect of FCV-F9 and MNV-1 was achieved when MAS or MAS-F1 was incubated with FCVF9 and MNV-1 simultaneously added to cells. MAS-F1 further exhibited significant reduction of the MNV-1 or FCV-F9 polymerase gene expression in a dose-dependent manner. Among the polyphenols, cyanidin-3-rutinoside was effective in reducing MNV-1 polymerase gene expression. The inhibition of viral infection by MAS or MAS-F1 against foodborne viral surrogates may occur at the initial stage of viral replication.

**Hyun-A Lee, Hye Won Lee, Jin Ah Ryuk, Ki-Jung Kil, Byoung Seob Ko. Anti-Rheumatoid Arthritis Effect of *Vitex rotundifolia* Extract on Mice with Collagen-Induced Arthritis. J. Korean Soc. Appl. Biol. Chem. 56(6):661-666**

Effects of 70% ethanol extract of the stems and leaves of V. *rotundifolia* (VRE) on the activation of IgG2 and histology in collagen-induced arthritis (CIA) as a model of rheumatoid arthritis were examined. Histological changes in the knee joints were evaluated and determined the serum anti-type II collagen IgG2a and IgG2b levels in CIA. VRE treatment significantly decreased the arthritis index, the synovial cartilage erosion, and the serum IgG2a and IgG2b levels, suggesting that V. *rotundifolia* might be useful for treating rheumatoid arthritis.

**Tran Minh Hoi, Ha Van Anh, Nguyen Thi Thanh Huong, Nguyen Van Tuyen, Le Thi Tu Anh, Nguyen Thanh Tra, Ba Thi Cham, Nguyen Thi Thu Ha, Pham Thuy Linh, Doan Duy Tien, Phan Van Kiem, Ninh Khac Ban, Lidziya Kukhareva, Gill Tatiana, Young Ho Kim. *Artocarpus nigrifolius*: Cytotoxic and Antibacterial Constituents. J. Korean Soc. Appl. Biol. Chem. 56(6):667-672**

Six known compounds including α-amyrin 3-acetate (1), β-sitosterol (2), betulinic acid (3), friedelan-3-one (4), artochamin B (5), and 2-C-methyl-D-erythritol 4-O-α-D-glucopyranoside (6) were isolated from the stem barks and leaves of *Artocarpus nigrifolius* (Moraceae) for the first time. Their structures were identified by spectroscopic methods as well as comparison with literatures. Cytotoxicity and antibacterial activity of 1-6 were evaluated. Results showed that artochamin B (5) possessed the highest cytotoxicity towards MCF7, Lu, HepG2, and KB cell lines with IC50 values of 4.59, 20.00, 3.60, and 1.18 μg/mL, respectively. It also inhibited the growth of Gram-positive bacteria (*Bacillus subtilis, Staphylococcus aureus*), whereas inactive on the growth of both Gram-negative bacteria and yeast.

**Krishna Chaitanya Sadanala, Bong Chul Chung. Graphene Nanoplatelets as a Solid Phase Extraction Sorbent for Analysis of Chlorophenols in Water. J. Korean Soc. Appl. Biol. Chem. 56(6):673-678**

Graphene nanoplatelets are a novel class of carbon nanostructures. They possess an ultra high surface area, and thus have great potentials for the use as sorbent materials. We herein demonstrate the use of graphene nanoplatelets as an adsorbent material for solid-phase extraction. Surface compositions of grapheme nanoplatelets were examined by X-ray photoelectron spectroscopy. Scanning electron and transmission electron microscopies were performed to elucidate the morphology of graphene nanoplatelets. Three chlorophenols, 3-chlorophenol, 4-chlorophenol, and 2,4-dichlorophenols were selected as model analytes and extracted on a graphene nanoplatelets-packed solid-phase extraction cartridge, followed by elution with alkaline methanol. The extracted chlorophenols were identified and quantified by UV-vis spectrophotometer. Under the optimized experimental conditions, good linearity (R2 >0.9969), recovery (95–103%), precision (<12%), and accuracy (<±9%) were achieved. The advantages of grapheme nanoplatelets as solid phase extraction adsorbent, such as good reusability and no impact of sorbent drying, have been detailed. The present study proposes a useful method for water sample pretreatment and reveals the potential of graphene nanoplatelets as an excellent sorbent material in analytical processes.

**Myoung-Ho Shin, Hyun-Seob Hwang, In-Bok Lee, Young-Ho Seo, Min-Kyun Kim. Dust Collection and Nutrient Absorption by Halophyte Communities in Saemanguem Reclaimed Land. J. Korean Soc. Appl. Biol. Chem. 56(6):679-686**

Halophyte community was established for dust prevention in Saemangeum reclaimed land from 2006 to 2008. In the present study, the functions of halophyte community were examined on-site in aspects of dust collection and nutrient absorption. In dust collection experiments, total suspended particulate (TSP) decreased through transplanted halophyte community and the reduction effect continued to 50 m leeward, which was 5.6 times of plant height. TSP reduction behind in-situ halophyte communities amounted to 25.6% on seven-monthly average. TSP collected within four halophyte communities varied among halophytic species in the field. Harvested in the reclaimed land, halophytic samples contained significant amount of nitrogen (0.84 to 1.71% of dry weight), P2O5 (0.05 to 0.21% of dry weight), and Na+ (0.08 to 3.20% of dry weight). On the basis of halophyte community area in 2006, the amount of total nitrogen, P2O5 and Na+ absorbed by *Suaeda asparagoides* was estimated up to 404,000, 47,000, and 498,000 kg, respectively. These results implied that halophyte communities are capable of both collecting significant dust particulates and absorbing of nitrogen, phosphorus, and sodium in the reclaimed land.

**Jeong Yong Moon, Sarah Lee, Seongweon Jeong, Jong-Chan Kim, Kwang Seok Ahn, Ashik Mosaddik, Somi Kim Cho. Free Radical-scavenging Activities and Cytoprotective Effect of Polyphenol-rich ethyl acetate Fraction of Guava (*Psidium cattleianum*) Leaves on H2O2-treated HepG2 Cell. J. Korean Soc. Appl. Biol. Chem. 56(6):687-694**

Total phenolic contents of different fractions of the Psidium cattleianum leaf extract and their antioxidant capacity against several free radicals were examined. Protective effect of the ethyl acetate fraction (EAF) on H2O2-induced DNA damage in HepG2 cells were also evaluated, and the phytochemical profile of EAF was analyzed using tandem mass spectrometry. EAF derived from the 80% methanol extract of the leaf contained a remarkable amount of polyphenol and showed high levels of DPPH and alkyl radical scavenging activity, promoted cell viability, and protected

against H2O2-induced DNA damage in HepG2 cells. Phytochemical analysis revealed that the major components in the EAF included quercetin monoglycoside, phloridizin, quercetin 3-diglycoside, quercetin-3-glucuronide, 2,6-dihydroxy-3,5-dimethyl-4-glucopyranosylbenzophenone,

phenolic acid, guaijaverin, and naringin. The present study suggests possible synergistic or competitive antioxidant action of the major compounds of cattley guava leaf on H2O2-induced DNA damage in HepG2 cells. These results indicate that the ethyl acetate fraction of the guava leaf could be used as a potential source of natural antioxidants, and these findings will facilitate the utilization of guava leaf as a source of functional food.

**Jae Hoo Lee, Hong Jin Lee. A Daidzein Metabolite, 6,7,4'-Trihydroxyisoflavone Inhibits Cellular Proliferation through Cell Cycle Arrest and Apoptosis Induction in MCF10CA1a Human Breast Cancer Cells. J. Korean Soc. Appl. Biol. Chem. 56(6):695-700**

Despite recent findings of hepatic daidzein metabolites on prevention of skin and colon cancers, little study has been performed on breast cancer. In this study, we found that 6,7,4'-trihydroxyisoflavone, one of the major hepatic metabolite of the daidzein more significantly inhibited proliferation of MCF10CA1a human estrogen receptor (ER)-negative breast cancer cells, which was derived from arresting cell cycle at S- and G2/M phase. Cyclins and cyclin-dependent kinases (CDKs) involved in S- and G2/M phases, including cyclins A, B, E, CDK1 and CDK2 were

regulated by 6,7,4'-trihydroxyisoflavone as well as CDK inhibitor, p21 and p27, in a dose-dependent manner. In addition, 6,7,4'-trihydroxyisoflavone induced apoptosis by enhancing death

receptor4 (DR4) expression and suppressing the X-linked inhibitor of apoptosis protein, leading to poly ADP-ribose polymerase cleavage. Taken together, 6,7,4'-trihydroxyisoflavone inhibits cell proliferation via arresting cell cycle at S- and G2/M phases and inducing apoptosis in MCF10CA1a human breast cancer cells. These results suggest that the hepatic metabolite of daidzein, 6,7,4'-

trihydroxyisoflavone, may be considered as a more potent agent in inhibiting ER-negative breast carcinogenesis.

**Young-Sook Cho, Dae-Sung Lee, Young-Mog Kim, Chang-Bum Ahn, Do-Hyung Kim, Won-Kyo Jung, Jae-Young Je. Protection of Hepatic Cell Damage and Antimicrobial Evaluation of Chitosan-Catechin Conjugate. J. Korean Soc. Appl. Biol. Chem. 56(6):701-707**

The chitosan-catechin conjugate was developed by free radical-induced conjugating reaction, and its protection ability against hydrogen peroxide-induced hepatic damage in human normal Chang liver cells and antimicrobial activity against methicillin-resistant Staphylococcus aureus (MRSA) and foodborne pathogens were investigated. Treatment of hydrogen peroxide (650 μM) on Chang liver cells decreased cell viability up to 59.38% compared to the non-treatment group; however, cotreatment of the chitosan-catechin conjugate increased cell viability up to 76.90% at 200 μg/mL, and the protection ability was significantly higher than the unmodified chitosan (p <0.05). The chitosan-catechin conjugate significantly (p <0.05) inhibited the formation of intracellular reactive oxygen species and lipid peroxidation in Chang liver cells. Moreover, the chitosan-catechin conjugate increased glutathione levels in normal condition as well as under oxidative stress by hydrogen peroxide. Additionally, the chitosan-catechin conjugate showed increased antimicrobial

activity against MRSA and foodborne pathogens as compared to those of the unmodified chitosan.

**Hee-Sook Park, Soon-Mi Shim, Gun-Hee Kim. Silydianin in Chloroform Soluble Fraction of**

***Cirsium japonicum* Leaf Inhibited Adipocyte Differentiation by Regulating Adipogenic Transcription Factors and Enzymes. J. Korean Soc. Appl. Biol. Chem. 56(6):709-713**

*Cirsium japonicum*, Compositae, a wild perennial herb found in Korea, Japan and China, has been used in traditional medicines. Effects of various solvent extracts of C. *japonicum* leaf on adipocyte differentiation in 3T3-L1cells were determined, and its mechanism was elucidated. 3T3-L1 cells were incubated with adipogenic hormone mixture mixed with various solvent fractions (hexane, chloroform, ethyl acetate, butanol, and water) of C. *japonicum* leaf. Adipogenesis was evaluated by triglyceride accumulation and expression of adipogenic genes by reversetranscription-polymerase chain reaction. All solvent fractions of C. *japonicum* leaf inhibited adipogenesis in adipocytes by

decreasing triglycerol concentration in a dose-dependent manner. Among solvent fractions of C. *japonicum*, the chloroform-soluble fraction was found to have the highest inhibitory effect on adipocyte differentiation. Silydianin was identified as a major bioactive component in chloroform-soluble fraction of C. *japonicum*. The extract suppressed the expression of genes such as PPARγ, C/EBPα, adiponectin, lipoprotein lipase, and fatty acid synthetase involved in adipogenesis, indicating that chloroform-soluble fraction of C. *japonicum* inhibited lipid accumulation in adipocyte by suppression genes involving adipogenesis. Thus, C. *japonicum* leaf extract containing silydianin could be a good natural candidate for the management of obesity.

**Yoo Seok Jeong, Hee Kyoung Jung, Joo-Heon Hong. Multiplex Real-time Polymerase Chain Reaction for Rapid Detection of *Staphylococcus aureus, Vibrio parahaemolyticus*, and *Salmonella typhimurium* in Milk and Kimbap. J. Korean Soc. Appl. Biol. Chem. 56(6):715-721**

This study presented a multiplex, single-tube, realtime polymerase chain reaction (RTi-PCR) approach for detecting *Staphylococcus aureus, Vibrio parahaemolyticus*, and *Salmonella typhimurium*, three of the more frequent foodborne pathogenic bacteria typically investigated in a variety of foods. New primer sequences were designed for detection of specific gene fragments in the 23s ribosomal RNA, transmembrane transcription regulator, and replication origin sequences of S. *aureus*, V. *parahaemolyticus*, and S. *typhimurium*. Simultaneous amplifications were performed under the optimized reaction conditions. Melting curve analysis using SYBR Green I RTi-PCR analysis produced characteristic Tm values for each target amplicon, demonstrating specific and efficient amplification of the three fragments. Addition of an internal amplification control did not affect detection sensitivity for the target pathogen. The analysis of frequent foodborne pathogenic bacteria in artificially inoculated food demonstrated analytical sensitivity for direct detection of each pathogen using the Chelex method rather than a commercial DNA extraction kit. The assay was sensitive to 103 colony-forming units (CFU)/reaction. With enrichment (2 or 4 h), each species could be detected at 101 CFU/g. These results provided that RTi-PCR is a rapid and costeffective procedure to detect foodborne pathogens. This assay could become a valuable tool for routine microbiological analysis in the food industry.

**Zulfiqar Ahmad, Masood Sadiq Butt, Anwaar Ahmed, Nauman Khalid. Xylanolytic Modification in Wheat Flour and its Effect on Dough Rheological Characteristics and Bread Quality Attributes. J. Korean Soc. Appl. Biol. Chem. 56(6):723-729**

Effects of various xylanase treatments applied at different stages of bread making process on dough rheological characteristics and bread quality attributes were investigated. Different doses (200, 400, 600, 800, and 1000 IU) of purified enzyme were applied at two stages (tempering and mixing). In milling and dough making processes, both types of flour (subjected to enzyme treatment during tempering and flour mixing) exhibited decreasing trend in water absorption, dough development time, dough stability, softening of dough, dough mixing time, viscosity peak, set back, and increasing tendency in peak height and pasting temperature. Treatments during tempering resulted in more significant effects as compared to applications during flour mixing. The dough rising during proofing resulted in enhancement from 137±3.21% (control) to maximum value (192.33±2.90%), when 600 IU of xylanases were applied to 1 kg of wheat grains during tempering. The bread sensory attributes also exhibited significant improvement in response to various doses of purified enzymes.

**Hui-Seung Kang, Sang-Do Ha, Seung-Weon Jeong, Mi Jang, Jong-Chan Kim. Predictive Modeling of Staphylococcus aureus Growth on Gwamegi (semidry Pacific saury) as a Function of Temperature. J. Korean Soc. Appl. Biol. Chem. 56(6):731-738**

Gwamegi (semidry Pacific saury [*Cololabis saira*]) is a Korean food made by a traditional method of repeated freezing and de-freezing during winter. The present study aimed at developing predictive modeling of S. aureus growth on Gwamegi as a function of temperature (10–35℃). Modified Gompertz, Baranyi, and logistic primary models were fitted to experimental values. Polynomial quadratic, nonlinear Arrhenius and square root models were selected as secondary models and analyzed using specific growth rate (μmax) and lag time (λ) values obtained from the primary models. Based on the optimized models derived from the Baranyi and square root equations for μmax, its r2 and mean square error (MSE) were 0.991 and 0.00058, and bias factor (Bf) and accuracy factor (Af) were 1.0087 and 1.0801, respectively. The logistic and polynomial quadratic equations for λ, its r2 and MSE were 0.989 and 0.22834, Bf and Af were 0.9742 and 1.0271, respectively. These predictive models can provide basic information for quantitative microbial risk assessment of Gwamegi and other processed semidried seafood.

**Yu Qian, Gui Jie Li, Kai Zhu, Hua Yi Suo, Peng Sun, Xin Zhao. Effects of Three Types of Resistant Starch on Intestine and Their Gastric Ulcer Preventive Activities *in vivo.* J. Korean Soc. Appl. Biol. Chem. 56(6):739-746**

To examine the effects of three types of resistant starch (RS) on intestinal metabolites, structure and their gastric injury preventive activities, Sprague-Dawley mice were fed diet containing 15% RS for 4 weeks. Response relationships among three types of RS (RS2, RS3, and RS4) food intake, body weight gain, food efficiency, wet weight of cecum (with or not with contents), pH, ammonia production, and short-chain fatty acids (SCFAs) concentration of cecal contents as well as intestinal

structure were investigated. All three types of RS had effects on food intake, weight control, lowering of pH, ammonia production in cecal contents, increasing the wet weight of cecum (with or without contents), changes in SCFAs concentration of cecal contents, and physiological structure of small intestine and cecum compared to the control group (common starch-fed rats). RS3 group showed minimum weight gain and food efficiency, compared to both the control group and the other two types of RS diet. RS3 group showed more significant lowering of pH, ammonia production, and SCFAs of cecal contents. In addition, all three types of RS shortened villous height, and muscle and mucosal thickening in small intestine, resulting in significantly decreased villous height and mucosal thickness, whereas significantly increased muscle thickness in the cecum. However, they did not cause detectable pathological changes in the small intestine and cecum. Animal model was also used to check its gastric ulcer preventive effects. The gastric ulcer level was significantly down-regulated by RS3, demonstrating its anti-inflammatory properties. RS3 reduced the levels of serum proinflammatory cytokines of IL-6, IL-12, TNF-α, and IFN-γ compared to RS2 and RS4. RS3 increased the somatostatin (SS) and vasoactive intestinal peptide (VIP), decreased the motillin (MOT) and substance P (SP) serum levels. These results suggest that RS3 shows the best gastric ulcer preventive effect.

**Kyeong-Hwa Seo, Dae-Young Lee, Tae-Gyu Nam, Dae-Ok Kim, Dong-Geol Lee, Eun-Kyung Kim, Hee-Cheol Kang, Myoung-Chong Song, Nam-In Baek. New Tocopherol Analogue with Radical-Scavenging Activity from the Peels of *Citrus unshiu* Marcovich. J. Korean Soc. Appl. Biol. Chem. 56(6):747-750**

One new tocopherol analogue, methoxytocopherol (1), and two known analogues, α-tocopherol (2) and γ-tocopherol (3), were isolated from the peels of *Citrus unshiu* Marcovich. The chemical structures of compounds 1-3 were determined by interpretation of spectroscopic data. All isolated compounds were evaluated for radical-scavenging capacity using 2,2'-azino-bis(3-ethylbenzthiazoline-6-sulfonic acid) diammonium salt, 1,1-diphenyl-2-picrylhydrazyl, and oxygen radical absorbance capacity assays.

**Dong Cheon Yun, Si Young Yang, Young Cheol Kim, In Seon Kim, Yong Hwan Kim. Identification of Surfactin as an Aphicidal Metabolite Produced by *Bacillus amyloliquefaciens* G1. J. Korean Soc. Appl. Biol. Chem. 56(6):751-753**

An aphicidal metabolite produced by *Bacillus amyloliquefaciens* G1 was isolated, and its activity was examined against green peach aphid (*Myzus persicae*). Bioassay-guided column chromatography followed by instrumental analyses identified surfactin as a major metabolite, showing LC50 value of 35.82 μg/mL. This is the first report of surfactin as an insecticidal metabolite against Myzus persicae.

**Jae-Joon Kim, Woo-Yeon Kim. Substrate Specificity of the Magnolia Flower Polyphenol Oxidase Separated on the Cation Exchanger and Hydrophobic Interaction Column. J. Korean Soc. Appl. Biol. Chem. 56(6):755-757**

Polyphenol oxidase (PPO) was separated from Magnolia (*Magnolia kobus*) flower by acetone precipitation and CMSepharose and Phenyl-Sepharose chromatographies. Molecular weight of the purified PPO from Magnolia flower was assumed to be just over 20 kDa on the sodiumdodecylsulfate-polyacrylamide gel electrophoresis and around 40 kDa under non-boiling without β-mercaptoethanol. Magnolia flower PPO showed the highest enzyme activity with chlorogenic acid as a substrate.

**Seon Ah Hwang, Kyeong-Bo Lee, Jae Young Cho. Degradation of Veterinary Antibiotic Oxytetracycline Using Electron Ionizing Energy. J. Korean Soc. Appl. Biol. Chem. 56(6):759-762**

Electron ionizing energy was used to determine the degradation rate and degraded products of oxytetracycline in aqueous solutions. The degradation efficiency on oxytetracycline after irradiation with electron ionizing energy was 72.2% at 1 kGy, 99.2% at 5 kGy, and 100% at 10 kGy. The degraded products of oxytetracycline after irradiation with electron ionizing energy were OTC1 ([M+H] *m/z* 447.2), OTC2 ([M+H] *m/z* 433.2) and OTC3 ([M+H] *m/z* 415.2). The results demonstrate that the irradiation technology using electron ionizing energy is an effective means to remove veterinary antibiotics in aquatic ecosystem.

**Ji-Yeon Yang, Jun-Hwan Park, Hoi-Seon Lee. Isolation of 8-hydroxyquinoline from *Sebastiania corniculata* and Antimicrobial Activity against Food-borne Bacteria. J. Korean Soc. Appl. Biol. Chem. 56(6):763-766**

Antimicrobial activities of the five fractions obtained from the methanol extract of *Sebasticania corniculata* plant were evaluated against five food poisoning bacteria using the agar diffusion method. The chloroform fraction possessed strong antimicrobial activities against five food poisoning bacteria. 8-Hydroxyquinoline was isolated from the chloroform fraction by the various chromatography analyses. When to the agar diffusion method was used, 8-hydroxyquinoline showed potent antimicrobial activities against five food poisoning bacteria. In the case of minimum bactericidal concentration or minimum inhibitory concentration, 8-hydroxyquinoline showed significantly higher antimicrobial activity against five food poisoning bacteria. Thus, the extract of S. *corniculata* and 8-hydroxyquinoline could be useful for the development of eco-friendly food supplemental agents.