

## Antifungal Efficiency of the Crude Hexane Extract and Daphnoretin from the Roots of *Linostoma pauciflorum* Griff. on *Sclerotium rolfsii*

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*Linostoma pauciflorum* Griff. belongs to the family Thymelaeaceae which comprises more than 898 species. This plant is scandent shrub which is widespread in the southern part of Thailand and it has several uses. For example, a dried mixture of the ground root and urine is wrapped in the leaves of *Senna alata* (L.) Roxb. is smoked as cigarette in order to relieve the symptoms of nasal polyps. The whole plant is used as fish poison while the water extract of this plant is used as insecticide. Daphnoretin is a well-known bis-coumarin derivative found principally in Thymelaeaceae and it has been isolated from the root and the vines of *L. pauciflorum* by Navarat, T. *et al.*, 2011. Interest in daphnoretin has been rekindled recently because of its diverse biological properties such as the *in vivo* antineoplastic activity against Ehrlich ascites carcinoma in mice and the inhibition of the tyrosine-specific protein kinase activity of human epidermal growth factor reporters. Moreover, this compound also showed strong suppressive effects on the expression of the hepatitis B surface antigen (HBsAg) in human hepatoma Hep 3B cells. This study reports the bioactivity of both the crude hexane extract and daphnoretin obtained from the roots of *L. pauciflorum* (isolated in our laboratory) to control the mycelial growth of *Sclerotium rolfsii* which is a causal agent of soil-borne plant disease. The mycelium of pathogen was cultured on potato dextrose agar amended with the crude hexane extract or daphnoretin at 0 (control), 2 and 100 mg/L, respectively. The data showed that the dose of 2 mg/L of the crude hexane extract and daphnoretin were able to inhibit the mycelial growth of *S. rolfsii* at 79.25 and 79.25%, respectively. At the concentration 100 mg/L, the crude hexane extract and daphnoretin were able to inhibit the mycelial growth of pathogen by 83.46 and 94.56%, respectively.

**Keywords** *Linostoma pauciflorum* Griff.; Daphnoretin; *Sclerotium rolfsii*

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# The Effect of Antioxidant and Fatty Acid Composition on Heat-Oxidation Stability of Blend Oil between Soybean Oil and Coconut Oil with Extracted Ginger

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Soybean oil contains unsaturated portion that are susceptible to oxidation. Antioxidant and medium chain triacyl glycerols (MCT) are often used to protect and inhibit heat-oxidation of vegetable oil. Coconut oil with extracted ginger contains high medium chain triacyl glycerols and high total phenolic compound. This oil has high stability to heat-oxidation. Therefore, coconut oil with extracted ginger (COEG) was blended with soybean oil (SO) to improve stability of blend oil. This objective of this work was to study the effect of antioxidant and fatty acid composition on oxidation stability of blend oil between 50% COEG and 50% SO compared with COEG, SO, virgin coconut oil (VCO) and 50% VCO + 50% SO. Antioxidant content including alpha tocopherol and total phenolic content, fatty acid composition and peroxide value at 80 °C for 35 days of these oil were determined. The total phenolic content was found to be 1260, 1569, 0, 0 mg/100g oil (expressed as Gallic acid) for 50% COEG and 50% SO, COEG, SO, VCO and 50% VCO + 50% SO. Alpha tocopherol content was found to be 15.4, 0, 31.7, 0, 11.1 mg/kg for 50% COEG and 50% SO, COEG, SO, VCO and 50% VCO + 50% SO. Saturated/unsaturated fatty acid ratio of 50% COEG and 50% SO and 50% VCO + 50% SO is nearly 1. The result indicated that these oils were the optimally stable composition. Moreover, It was found that peroxide value of 50% COEG and 50% SO is lower than 50% VCO + 50% SO and SO but is higher than COEG and VCO. Result showed the blend oil of 50% COEG and 50% SO was higher heat-oxidation stability than 50% VCO + 50% SO and SO. It was concluded that the heat-oxidation stability of blend oil depend on antioxidant content and fatty acid composition.

**Keywords** Coconut oil with extracted ginger; Virgin coconut oil; Antioxidant; Fatty acid composition; Heat-oxidation stability; Soybean oil

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## Antimicrobial Screening of Jackfruit and Sugar-Apple Fruit Extracts

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The *in vitro* antibacterial activities of different extracts from peels, pulp, seed of jackfruit and sugar-apple fruit and jackfruit-fiber were investigated by agar-well diffusion and broth dilution methods. Seven bacteria (*Bacillus subtilis*, *Staphylococcus aureus*, *Micrococcus luteus*, *Pseudomonas aeruginosa*, *Serratia marcescens*, *Escherichia coli*, and *Salmonella typhimurium*) were tested. The solvents used in this study were water, 95% ethanol, and acetone. Their total phenolic contents and total acidity were also evaluated. The water extract of jackfruit pulp contained high level of total acidity (23.05 g/L) but low level of total phenolic content (0.85 mg GAE/g dry weight of fruit) and exhibited antibacterial activity against all bacteria tested. The minimal inhibitory concentrations (MIC) of this extract against *P. aeruginosa* and *S. marcescens* were 150.70 mg/ml and were 1,507.20 mg/ml against the others. Furthermore, the acetone extracts of jackfruit seed, peel and fiber demonstrated antibacterial activities against *B. subtilis* only (inhibition zone  $\leq$  11 mm), while the ethanol extract of jackfruit fiber showed antibacterial activity only against gram-positive bacteria (inhibition zone  $\leq$  11.3 mm). On the other hand, all extracts from sugar-apple fruit did not show antibacterial activity against all bacteria tested with their total phenolic content of less than 22 mg GAE/g dry weight of fruit and total acidity of less than 9 g/L.

**Keywords** Jackfruit; Sugar-apple; Antibacterial activity, Total phenolic content, Total acidity

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## Types and Content of Phenolic Acids in Tea Lotus Products

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Lotus, *Nymphaea lotus* Linn, *Nelum bonucifera* Linn. And *Nelum bonucifera* Gareth, have been cultivated in Loei province of Thailand. Different parts of lotus can be made into many foods such as soup and tea products. The purpose of this study was to determine types and content of phenolic acids in tea products derived from different parts of three lotus by spectrophotometry and chromatography techniques. The highest total phenolic contents found in tea lotus petal and tea pollen products from *Nymphaea lotus* Linn. were  $7.92 \pm 0.87$  and  $6.57 \pm 1.25$   $\mu\text{g GAE/g}$  of tea lotus, respectively. Tea pollen product from *Nelum bonucifera* Linn. contained the highest total phenolic content ( $8.20 \pm 0.58$   $\mu\text{g GAE/g}$  of tea lotus). Similarly, Tea pollen product from *Nelum bonucifera* Gareth. contained the highest total phenolic content ( $7.37 \pm 0.66$   $\mu\text{g GAE/g}$  of tea lotus). Types of phenolic acids found in tea lotus products were gallic acid, ferulic acid and *p*-coumaric acid. Tea pollen product from *Nymphaea lotus* Linn. show the highest of gallic acid ( $690.07 \pm 167.18$  ng/g of tea lotus). But, ferulic acid and *p*-coumaric acid was found in tea internodes product from *Nymphaea lotus* Linn. ( $274.19 \pm 33.41$  and  $183.90 \pm 0.43$  ng/g of tea lotus). Gallic acid ferulic acid and *p*-coumaric acid in tea products from *Nelum bonucifera* Linn. found in leaf products. Finally, tea leaf product from *Nelum bonucifera* Gareth. Show the highest of ferulic acid was  $30.66 \pm 15.74$  ng/g of tea lotus. But, tea petiole product from *Nelum bonucifera* Gareth. show the highest of gallic acid and *p*-coumaric acid were  $73.32 \pm 4.99$  and  $22.06 \pm 5.78$  ng/g of tea lotus, respectively. Tea pollen product from *Nymphaea lotus* Linn. it may be suitable for development in the next step.

**Keywords** Lotus; Tea lotus; Phenolic acids

# Modification and Characterization of Plant Derived Materials Containing Capsaicin

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A protection scheme for the phenolic group of capsaicin was being developed with the aim of reducing the pungency of capsaicin containing materials at the point of application or ingestion. The protection was carried out with groups that can be enzymatically removed in living objects. In other words the synthesized derivatives should have pro-drug (procapsaicin) like characteristics. Furthermore, the protection was devised so that it can be carried out using pure capsaicin as well as crude extract from chili peppers. Acetyl and dimethyl carbamoyl protected capsaicin derivatives have been prepared and characterized by <sup>1</sup>H NMR and LC-MS. These compounds have been used as standards for the development of LC-MS conditions for the analysis of protection reactions with crude extract of chili peppers. The formation of acetyl and dimethyl carbamoyl protected capsaicin derivatives in protection reactions carried out with crude extracts has been confirmed using LC-MS. Optimization of the protection reactions in terms of solvent used was carried out. Furthermore, the possibility to carry out the acetylation reaction using an immobilized lipase enzyme has been investigated. Enzymatic deprotection of the capsaicin derivatives has been studied.

**Keywords** Capsaicin; Procapsaicin; Chili peppers; Protecting group

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## Development of Poly(vinyl alcohol) Films Entrapped with Butterfly Pea Extract for Seafood Spoilage Detection

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This research aimed to develop a non-toxic, environmentally friendly seafood spoilage indicator in the form of label film, by incorporating butterfly pea (BP) extract into a poly(vinyl alcohol) (PVA) matrix. The BP extract contains anthocyanins that can respond through visible color change to volatile amines released during the seafood spoilage period. The dried BP extract was prepared by acidic ethanol extraction followed by vacuum drying. The anthocyanin content was found to be 6.70 mg/g of the dried BP extract. The stability study showed that the anthocyanin content began decreasing after 2 weeks of storage at 4°C, in darkness and under N<sub>2</sub> atmosphere. The BP extract-entrapped PVA films were prepared via solution casting technique. The amount of the BP extract added was varied to be 2.4, 3.2 and 4.0 wt% of the PVA matrix. By adjusting the pH of the casting solutions to 1.5 and 2, the films appeared red. The color intensity of the films increased with increasing the BP extract content. The study on the ability to respond to NH<sub>3</sub> vapor revealed that the films gradually changed from red to blue and then green in response to the increasing NH<sub>4</sub>OH concentrations. In addition, the color change was observed when tested with fresh shrimps, indicating that the films were capable of detecting volatile amines produced from seafood spoilage. Thus, the developed BP extract-entrapped PVA films have a potential application as a seafood spoilage indicator.

**Keywords** Seafood spoilage indicators; Volatile amines; Anthocyanins; Butterfly pea extract

## Phytotoxic Activity of Essential Oils from Marigold (*Tagetes erecta* L.)

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The essential oils from leaves and flowers of *Tagetes erecta* were extracted using the hydrodistillation method. Gas chromatography/mass spectroscopy (GC/MS) analysis of the isolated essential oil showed that the major constituents of essential oils from *T. erecta* leaves were piperitone (29.10%), terpinolene (9.81%), limonene (6.86%), caryophyllene (6.03%) and piperitenone (1.93%). The major constituents of essential oils from *T. erecta* flowers were caryophyllene (17.4%), linalool (4.4%), and  $\alpha$ -terpineol (1.9%). The essential oils at different concentrations; 62.5-2,000 ppm, were tested for their inhibitory effects on seed germination and seedling growth against dicot plant, *Amaranthus tricolor*. The phytotoxic assay results showed that the essential oil from *T. erecta* leaves had completely inhibitory effects against weed seeds at concentrations 1,000-2,000 ppm which was highly inhibitory effects than the essential oil from *T. erecta* flowers. Our obtained results suggested that *T. erecta* might produce allelopathic essential oils which could be employed as an eco-friendly agriculture.

**Keywords** Marigold; *Tagetes erecta*; Essential oil; Phytotoxic activity; *Amaranthus tricolor*

## Proficiency of Indian Almond Leaves as Antibacterial Source

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The aim of this work was to analyse tannic acid content in Indian almond leaves for evaluation the proficiency of antibacterial activity. The pale green leaves, dark green leaves and orange brown leaves were sampled to analyse tannic acid by spectrophotometry technique. The samples were prepared by fermentation in water and white spiritual liquor for 30 days. The results revealed that tannic acid could be measured in all Indian almond leaves that fermented in water and alcoholic solvent in the range of  $16.05 \pm 1.96$  mg/100g to  $62.63 \pm 2.38$  mg/100g respectively. The orange brown leaves fermented in white spiritual liquor for 30 days showed the highest tannic acid content. This work proved that Indian almond leaves taken from different periods could be used as antibacterial source.

**Keywords** Indian almond; Tannic acid; *Terminalia catappa* L.

## GABA and Antioxidant Activity in Different Cultivars of Germinated Brown Rice

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Germinated brown rice is well-known for richness of gamma amino butyric acid (GABA) and antioxidant activity during germination process. Gamma amino butyric acid (GABA) is a compound known to prevent Alzheimer's disease which is a problem in adults. The 5 different type of brown rice cultivars as Pathum Thani 1, Jasmine Rice 105, Red Jasmine, Hom Nin Rice (Black Cargo Rice) and black rice was used to study in this research. The germination process was performed by soaking brown rice in clean water for 24 hours, then was cleaned and incubated for 4-6 hours until the sprout has a length about 0.5 mm to 1 mm after that washed with clean water, steamed for 15 minutes and dried at 40-60 °C for 1 day. The physical properties of moisture, lightness (L\*), yellowness (b\*), redness (a\*) and germination rate were evaluated. The chemical properties as gamma amino butyric acid (GABA) and antioxidant were investigated.

**Keywords** Germinated brown rice; GABA; Antioxidant; germination

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## Enhancement of Brown Rice Germination Soaked with Different Solvents

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The purpose of this research was to study the brown rice germination with four different solvent-soaked such as water, water - coconut water (3: 1), water - corn (3: 1), water – *Centella Asiatic* (3: 1). The Pathum Thani 1 rice was used in germination process. The seeds were cleaned and soaked in 4 solvents for 12, 24, 36 and 40 hours then washed with clean water and incubated at 4 to 6 hours, after that washed with clean water and steamed for 15 minutes. The seeds were dried to reduce the moisture of germinate brown rice at 40 - 60 °C in oven, the moisture was reduced to 12%. The germination rate, Gamma-Aminobutyric acid (GABA) and Antioxidant were evaluated. These results will be used in the germinated brown rice processing.

**Keywords** Germinated brown rice; GABA; Antioxidant; Germination rate

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## Characterization of *Moringa oleifera* Lam. Seed Oil Varieties in Screening for Commercial Plantation

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*Moringa oleifera* (Horseradish tree) oil is high quality oil that can be used in high value food, cosmetic, and pharmaceutical product. *M. oleifera* tree has never been successfully production on the commercial plantation in Thailand due to the unavailable good variety for the high oil content. Our present work reports the chemical characterization of *M. oleifera* seed around 104 varieties that imported from India and corrected in Thailand. The *M. oleifera* seed were extracted with hexane in Soxhlet extractor for the oil content analysis. The oils were further analyzed for their fatty acid composition by gas chromatography (GC). The result showed that four groups of oil level were classified. The 28, 44, 24 and 8 varieties were found in the oil content range of 25.00-30.00%, 30.01-35.00%, 35.01-40.00% and 40.01-45.00%, respectively. The result of fatty acid composition showed that the oil contained high level of unsaturated fatty acid, especially oleic acid (up to 77.12%), followed by palmitic, stearic, behenic, eicosenoic and linoleic acid. In addition, eight varieties (40.01-41.68%) of oil content were selected for commercial plantation and analyzed for their vitamin E ( $\alpha$ -tocopherol and  $\gamma$ -tocopherol) content by high performance liquid chromatography (HPLC) for comparing with commercial olive oil.

**Keywords** *Moringa oleifera*; Characterization; Oil content; Vitamin E

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## Natural Food Colorants from Ten Varieties of Local Plants Grown in Kamphaeng Phet Province

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The pigments obtained from 10 different local plants from Kamphaeng Phet Province were studied. These plants were *Sauropus androgynus* Merr., *Tiliacora triandra* Diels., *Amaranthus lividus*, *Cratogeomys formosum* (Jack) Dyer ssp. (*Pruniflorum* (Kurz.) Gogelin, *Momordica charantia* L., *Passiflora foetida* Linn., *Glinus oppositifolius* A. DC., *Basella rubra* Linn., *Colubrina asiatica* Brongn. and *Clitoria ternatea* L. The local knowledge method was used to extract pigment colors which green color (Chlorophyll a) amounts from *Colubrina asiatica* Brongn., *Tiliacora triandra* Diels. and *Amaranthus lividus* were 0.182, 0.079 and 0.061 mg/ 100 g fresh weight. The extracts from *Colubrina asiatica* Brongn., *Tiliacora triandra* Diels., and *Amaranthus lividus* contained Chlorophyll b, which is green pigment of 0.085, 0.058 and 0.045 mg/ 100 g fresh weight. The extracts from *Tiliacora triandra* Diels., *Basella rubra* Linn., and *Glinus oppositifolius* A. DC. contained Beta-carotene, which is orange pigment of 9.720, 6.125 and 5.970 mg/100 g fresh weight. The extracts from *Clitoria ternatea* L., *Passiflora foetida* Linn., and *Colubrina asiatica* Brongn contained Anthocyanin, which is blue pigment of 11.784, 11.523 and 8.572 mg/100 g fresh weight.

**Keywords** Food Color, Pigment, Local Plant

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## Effect of Sweeteners and Thickening Agents on Melting Temperature and Viscosity of the Primary Yakitori Sauce

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In manufacturing process, melting temperature and viscosity are important properties of glazing sauce and frozen yakitori products. These two properties are generally used to predict frozen-state stability. The research objective was to study the effect of ingredients (sweeteners and thickening agents) on melting temperature and viscosity of yakitori sauce. The study used the primary sauce which only contains the main sauce ingredients including sweeteners, thickening agents and Johnin Soy sauce). The sweeteners were mixture of 24-29DE glucose syrup and sucrose (5:25, 10: 20, 15:15 and 20:10w/w). Thickening agents were modified tapioca starch (SMS757 and TAS110, at 4-5%w), and gum (xanthan gum and guar gum, at 0.1-0.2%w). The results showed that sweetener with higher glucose syrup concentration gave higher transition temperatures (both  $T_m$  and  $T_g$ ) and a slight decrease in sauce viscosity and Brix value. The melting temperature was found associated with the melting of unbound ice phase and can be observed visibly as an initial state of the sauce melting on product surface. Replacing sucrose (MW=342) with glucose syrup (MW=647) reduced number of dissolved sugar molecules and, thus, allowing ice phase to be melted at higher temperature. Thickening agents (both modified starch and gum, especially TAS110) greatly increased viscosity and amount of sauce taken-up to the product, but did not significantly affect the transition temperatures and Brix value. Results from our study are useful for development of new Yakitori sauce recipes with proper viscosity range and high frozen-state stability.

**Keywords** Yakitori sauce; Glucose syrup; Modified starch; Melting temperature; Viscosity

## Effect of Water Spray Chilling or Water Immersion Chilling on Qualities and Total Yield of Chicken Breast and Thigh

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The experiment was carried out to investigate the effect of chilling methods (water immersion chilling; WIC and water spray chilling; WSC) on qualities and total yield of chicken breast and thigh. For WIC, broiler carcasses were subjected to a continuous ice-water immersion system in agitated vessel for 80 min (final carcass temperature was 4°C) whereas for WSC, two spray intervals e.g. 1 and 5 min were investigated. Water spray treatments were continuously conducted until carcass temperature reached 4°C. After chilling, the carcasses were weighed and cut up. Moisture content, pH, water holding capacity (WHC), hardness, and color parameters were measured in chicken breast and thigh. After cooling at 4°C for 48 h, drip loss was evaluated and then samples were steam-cooked and measured for total yield. The results showed that spray intervals had no significant effect on both chicken breast and thigh ( $P>0.05$ ). Water uptake, moisture content, drip loss, pH and lightness ( $L^*$ ) of both chicken parts from WIC were significant higher than those of WSC ( $P\leq 0.05$ ). An opposite trend was observed for WHC, redness ( $a^*$ ) and total yield. Hardness and yellowness ( $b^*$ ) were not affected by chilling method ( $P>0.05$ ). Thigh meat had higher WHC,  $a^*$  and hardness but lower cooking loss,  $L^*$  and  $b^*$  than breast meat. Those results demonstrated that SC could be an alternative to WIC.

**Keywords** Water immersion chilling; Water spray chilling; Breast and thigh meat quality; Total yield

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## Parameters Affecting on Amount of Ice used in Water Immersion Chilling of Broiler

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Water immersion is generally used in Thai broiler industry to lower carcass temperature from approximately 40°C to below 4°C. Water and ice are used as cooling medium. Remaining ice in chillers causes temperature fluctuation problem in the process. Failure to control water temperature leads to poor meat quality and high energy consumption. This research aimed at investigating parameters affecting melting rate and amount of ice used in broiler carcass chillers. The results showed that qualities of water used to make ice such as water hardness, chlorine residual and pH had no effects on melting rate. Ice size significantly affected melting rate ( $P \leq 0.05$ ). The larger the size of ice, the lower the surface area to volume ratio and melting rate. In next experiment, 2 sizes of ice were used in a pilot-scale air agitated water chilled tanks, i.e., 2.5 x 2.5 x 0.2 cm and 6 x 7.4 x 2.7 cm. The results revealed that ice size had effect on amount of ice used to control water temperature. The greater impact was observed when the medium temperature was close to 0°C. Using 2.5 x 2.5 x 0.2 cm ice could reduce amount of ice in cooling process 12.88% as compared with 6 x 7.4 x 2.7 cm ice.

**Keywords** Water immersion chilling; Chicken carcasses; Ice; Melting rate; Ratio of surface area and volume

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## Iron Fortified Rice used Edible Local Plants for Consumption

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This research was to investigate the optimum type of edible local plants and the method to iron fortified rice. Ten species of edible local plants including: *Dryopteris amboinensis* Kuntze. (Pakkood), *Ocimum americanum* L. (Manglak), *Ocimum tenuiflorum* L. (Kapaowdeang), *Piper sarmentosum* Roxb.L. (Chaplu), *Polygonum odoratum* Lour. (Pakpai), *Basellarubra* L. (Pakpraung), *Morinda citrifolia* L. (Baiyor), *Lasia spinosa* (L.) Thwaites. (Paknham), *Momordica cochinchinensis* (Lour.) Spreng. (Fakkaow) and *Camellia sinensis* (L.) Kuntze var. *assamica* (Mast.) Kitam. (Baimeang) were selected for their ability to produce iron because they have high iron contents. Two methods of producing iron fortified rice are by coating edible local plants using the ratio Chainat 1: ground edible local plant: plamitic acid (1: 0.05: 0.4) and soaking in edible local plant extracts using the ratio Chainat 1: edible local plant extract (100 g.: 50 ml.) which edible local plant extracts prepare by ratio of edible local plant: water (70 g.: 50 ml.). Next, the optimum method for cooking iron fortified rice by varying washing time of modified rice was also studied. Finally, the storage duration time of iron fortified rice production was assessed at 10, 15, 20, and 25 days by checking fungal growth using Hygicult Y&F test kit. This research found that the iron fortified rice production with the coating method had higher yield of iron than soaking method. Coating rice with *O. tenuiflorum*, *Morinda citrifolia* and *Piper sarmentosum* which had a maximum iron content of 3.64, 3.05 and 2.97 mg/100 g., respectively. For cooking by washed and unwashed methods, the unwashed method had higher iron content than the washed method. Moreover, the iron fortified rice production used the coating method can be stored for 10-15 days depending on the species of edible local plant while iron fortified rice production from soaking method can be stored for 10 days.

**Keywords** Rice fortified; Local plant; Consumption

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# <sup>13</sup>C-NMR Monitoring of Stability Evaluation of Unrefined Organic Rice Bran Oil

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The stability of organic rice bran oil (RBO) was observed by nuclear magnetic resonance and convention methods (IV, PV and acid values). The objectives of this work are to observe the detailed characterization of glycerol carbons in different glycerides of organic RBO over one year period. The influence of refining processes and aging on the chemical stability of the oils was studied in terms of the ratio of 1,3-diacylglycerides to total diacylglycerides and 1-monoacylglycerols to total monoacylglycerides. The results indicate some hydrolytic degradation of RBO.

**Keywords** NMR; Organic rice bran oil; Stability; Unrefined oil

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## Photo Stimulated Luminescence Sensitivity of Irradiated Flour during Storage

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The detection of foods by photo stimulated luminescence (PSL) is the application technique to identify whether foods are irradiated or not. This experiment was done on the non-irradiated and irradiated flour measured by photo stimulated luminescence analyzer. The 2 radiation types, electron and gamma rays at the dosages of 1, 5 and 10 kilo grays were used to treat on 5 kinds of flour made from cassava, wheat, corn, rice and glutinous rice. The samples were kept for 6 months and were also analyzed for signal changes. The results showed that the PSL sensitivity varied depending on kind of flour, doses of radiation and storage time. The positive signals (> 5000 counts /60s) should be shown on measurement of irradiated foods and negative signals (< 700 counts /60s) is regarded to non-irradiated foods. The PSL signals provided absolutely correct measurement only on both non-irradiated and irradiated wheat flour throughout 6 months storage. The results showed an intermediate signals(700-500 counts /60s) on irradiated flour from cassava, rice and glutinous rice at all dosages used. The irradiated corn flour showed positive signals after 3-6 months of storage then the signals changed to intermediate signal. The PSL sensitivities of the irradiated samples were higher in samples treated with greater doses but the values decreased during storage. However, all kinds of non-irradiated flour remained on negative signals throughout the storage time. The results obtained from electron irradiation were corresponded to the gamma ray treatment. It was concluded that PSL technique can be used to differentiate non-irradiated and irradiated flour product.

**Keywords** Photo stimulated luminescence (PSL); Flour; Electron radiation; Gamma radiation

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## Flow Injection Spectrophotometric using Butterfly Pea Flower Extract as Reagent for the Determination of Acetic Acid

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Flow injection analysis (FIA) system with spectrophotometric detection was designed and constructed for the determination of acetic acid in vinegar. The FI system was carried out by injecting a 20  $\mu\text{L}$  of sample and/ or standard solution of acetic acid into the water carrier stream then using reagent stream containing 1.0% w/v butterfly pea flower extract, measuring the absorbance at a wavelength of 550 nm. The standard curve of FIA method was done in the acetic acid concentration range from 0.5 to 2.0% v/v and the concentration range from 4–to 10% v/v, with the correlation coefficient was 0.9997 and 0.9991 respectively, with the Limit of Detection (LOD) was 0.15% v/v, and Limit of Quantitation (LOQ) was 0.50% v/v. Sample throughput of 48  $\text{hr}^{-1}$  was achieved with the consumption of 1 mL each of carrier and reagent solutions per injection. The developed method was successfully applied to vinegar samples, validated by the acid-base titration method. The proposed method was simple, fast, economical and could be classified as a greener analytical method.

**Keywords** Flow injection analysis; Spectrophotometric method; Butterfly pea flower extract; Acetic acid; Vinegar

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## Content of Heavy Metal in Samples from Nakhon Si Thammarat Municipal Area

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The analysis of heavy metal such as Iron Copper Lead Cadmium and Chromium in mullet fish samples from Nakhon Si Thammarat in the South of Thailand was studied. Mullet fish samples were collected from Khlong Thasak, Khlong Pakpoon, Khlong Pakpaya and Khlong Paknakhon between April 2014 and September 2014. The content of 8.45 to 66.31, 0.37 to 3.49, 0.50 to 1.98, 0.17 to 1.28 and 0.07 to 0.09 mg/L for Iron, Copper, Lead, Cadmium and Chromium, in mullet samples, respectively were achieved with Atomic Absorption spectrophotometry. This research can use as database for food Safety.

**Keywords** Iron; Copper; Lead; Cadmium; Chromium

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## Adsorption of Ammonia by Agricultural Materials

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In this research, the adsorption of ammonia by agricultural materials such as dried leaves, rice hull, sawdust, rick husk, soil, and charcoal were studied. All agricultural materials are used as the bedding materials for pig. The optimized conditions were studied by varying types of adsorbents, contacting time, amount of adsorbents, and the concentrations of ammonia solution. The concentrations of ammonia were determined by phenol hypochlorite method with UV-visible spectrophotometer at 632.5 nm. The optimized condition to adsorb ammonia by agricultural materials were contacting time at 4 hours with the concentrations of ammonia at 0.66, 10.00, 5.00, 0.66, 0.50 and 6.66 mg/L per 1 g of dried leaves, rice hull, sawdust, rick husk, soil, and charcoal, respectively. The rick husk provided the highest percentage of adsorption of ammonia as 98.10. The mixed agricultural materials provided the higher percentage adsorption of ammonia than each agricultural material. It indicated that such agricultural materials could promote each other as effective as the adsorbent for the adsorption of ammonia.

**Keywords** Adsorption; Ammonia; Agricultural materials; Phenol hypochlorite

## Preparation of 2,4-Dichlorophenoxyacetic Acid Encapsulated Poly(vinyl alcohol) Hydrogel Microbeads by Water-Oil Emulsion Technique

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To improve efficacy of 2,4-dichlorophenoxyacetic acid (2,4-D) utilization, 2,4-D encapsulated poly(vinyl alcohol) (PVA) hydrogel microbeads were prepared via water-oil emulsion technique. The effects of preparation conditions on the particle size distribution, swellability and entrapment efficiency of 2,4-D encapsulated PVA hydrogel microbeads were also studied. Neat PVA hydrogel microbeads (without 2,4-D) were firstly prepared to acquire the proper preparation conditions. It was found that the PVA hydrogel beads were successfully formed, when soybean oil was used as an oil phase, with fixed concentrations of 10.0 wt% PVA, 26.5 %w/v glutaraldehyde as a crosslinking agent and 1.0 wt% Span 80 as an emulsifier, respectively. 2,4-D encapsulated PVA hydrogel microbeads could not be formed at the 6.6 %w/v glutaraldehyde since it had very low degree of crosslinking. As decreasing the PVA concentration from 10.0 wt% to 5.0 wt%, the average particle size was almost twice smaller. The swelling ratio and crosslink density were found to be greatly influenced by the PVA concentration, i.e. the lower the amount of PVA, the lower the swelling ratio, but the greater the crosslink density, while the stirring speed and stirring time did not have any significant effect on the swelling ratio and crosslink density. Furthermore, decreasing the amount of PVA resulted in increases in the 2,4-D content and entrapment efficacy.

**Keywords** 2,4-dichlorophenoxyacetic acid; Controlled release; PVA hydrogel microbeads; Water-oil emulsion

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## Biochemical Properties and Antioxidant Activity of Pineapple (Smooth Cayenne) Core Extract

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Pineapple core from Smooth Cayenne, contain several advantages, was selected and extracted. Pineapple core was firstly extracted with water, methanol and buffer pH 3, 5, 7 and 9. Afterwards, crude extracts from each treatment was precipitated by 50% (v/v) acetone. The supernatant and precipitate were evaluated for bromelain and cellulase activity. In addition, antioxidant, phenolic content and flavonoid content were also investigated. The sample from water (pH 7) extraction gave a highest value for all parameters tested in this study. The precipitate yield highest bromelain activity ( $1.79 \pm 0.06$  U with specific activity at 3.59 U/mg protein). However, highest cellulase activity (24.18 U), antioxidant (70.78% radical scavenging), phenolic content ( $13.02 \pm 0.15$  mg gallic acid equivalent/g dry extract) and flavonoid content ( $62.88 \pm 0.28$  mg rutin/g dry extract) was observed from supernatant.

**Keywords** Antioxidant; Bromelain; Cellulase; Smooth cayenne

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