Simultaneous Analysis of Biogenic Amines in Fermented Foods using High-Performance Liquid Chromatography

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A high-performance liquid chromatographic for the simultaneous analysis of five biogenic amines (including histamine, tryptamine, cadaverine, tyramine, and spermidine) in fermented foods after derivatization with 9-fluorenylmethyl chloroformate (FMOC) was developed. The separation of FMOC-derivatives of biogenic amines was achieved on a Waters Symmetry column C18 (5 µm; 3.9 mm x 150 mm) at a flow rate of 0.7 mL min⁻¹ using gradient elution of acetonitrile and 1 % acetic acid. The detection was performed using fluorescence detector at excitation wavelength of 270 nm and emission wavelength of 315 nm. The method linearity was in the range of 20-1000 ng mL⁻¹ with the correlation coefficients higher than 0.99. The limit of detection (LOD) and limit of quantitation (LOQ) were in the ranges of 0.3-5 ng mL⁻¹ and 1-15 ng mL⁻¹, respectively. The repeatability and reproducibility of the proposed procedure in respect of peak area expressed as RSD were in ranges of 4.63 to 7.55 % and 4.39 to 9.33 %, respectively. The recoveries of around 92.34-106 % were obtained for most of the compounds. The developed method was successfully applied to the determination of biogenic amines in fermented fish (Plaa-som), wine, and beer samples.

Keywords Biogenic amine; Plaa-som; 9-fluorenylmethyl chloroformate; HPLC
Phenolic and Flavonoid Contents in *Annona Squamosa* Linn. Leave Extracts by LC-DAD-MS

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*Annona squamosa* Linn. has been used as drugs and pesticides. Phenolic compounds were one of active substances. In this research, the determination of phenolic and flavonoid in *Annona squamosa* Linn. leaves were studied. Extraction methods studied were maceration, Soxhlet, reflux, ultra sonication assisted extraction and microwave assisted extraction with water, methanol, ethanol, acetone, hexane and ethyl acetate as solvents. Determination of total phenolic compounds by Folin-Ciocalteu’s phenol reagent assay was also performed. The ethanolic reflux extraction was selected as it gave the higher in %crude yield, total phenolic and total flavonoid contents but less toxicity than methanol one. Chemical components of the crude extracts were analysed by using HPLC-DAD mass spectrometry with API-ES mode. Mobile phase system was composed of acetonitrile and 10 mM ammonium formate buffer pH 4.0.

**Keywords** Phenolic content; Flavonoid content; *Annona squamosa* Linn.; LC-MS
Microencapsulation of Probiotic Bacteria *Pediococcus pentosaceus* by Water-in-oil Emulsion

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This work aims to increase survival of *Pediococcus pentosaceus* during gastric transition cause major loss of viability. This probiotic bacteria was considered for conferring beneficial effects to swine gut health. The objective of this study was to develop a protection system using a hydrolyzed milk protein and polysaccharide complex which should be able to protect the probiotic bacteria during their gastric transit and also release them under suitable conditions in the intestine. The protein-polysaccharide complex was carried out with milk protein hydrolysate (MPH), 0.5 % (w/v) xanthan gum or/and 0.25 % (w/v) gellan gum. Cells were successfully entrapped into the gel matrix of forming a water-in-oil emulsion. The appropriate combination ratio was of MPH: xanthan gum (1:1) and MPH: xanthan gum: gellan gum (1:0.5:0.5). Microcapsules of upper emulsion had fine and uniform size of diameters ranging from 50 to 70 µm after gravity settlement for 10 minutes. The encapsulated bacteria cells in simulated gastric juice at pH 2.0 for 2 h and in simulated intestinal juice at pH 7.4 for 4 h were tested continuously in an *in vitro* model. The result showed 96 % survivability of encapsulated cells after incubation for 2 h, despite these cells grew double amount after incubation for 4 h. Thus, the type and ratio of the polymer could be utilized as an effective microencapsulation technique for production of swine supplement.

**Keywords** Microencapsulation; Protein-polysaccharide complex; Water-in-oil emulsion; Probiotics
Effects of Biocides on Chlorophyll Contents of Detached Basil Leaves

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Herbicides and insecticides have been widely and intensively used in agricultural areas worldwide to enhance crop yield. However, many biocides cause serious environmental problems. In addition, the biocides may also have some effects on the treated agricultural crops. To study effects of biocides on chlorophyll content in detached basil leaves, 2,4-D dimethylamine salt (2,4 D-Amine), paraquat, carbosulfan, and azadirachtin, were chosen as representatives of biocide. After applying the chemicals to detached basil leaves overnight in darkness, chlorophyll contents were determined using spectrophotometric method. Only treatment with 2,4 D-Amine resulted in approximately 50% reduction of chlorophyll contents compared to treatment with deionized (DI) water. In the case of paraquat and carbosulfan, chlorophyll contents were not significantly changed, while slightly higher chlorophyll contents, up to 126.8%, compared to DI water, after the treatment with azadirachtin, were observed. The results indicated that 2,4 D-Amine shows an ability to accelerate chlorophyll degradation, but azadirachtin helps to retard chlorophyll degradation, when 50 mL of each biocide is used at the concentration recommended by the manufacturer.

Keywords Chlorophyll; Biocide; Agriculture; Detached leaf
Determination of Cu, Fe, Mn and Zn in Brown and White Jasmine Rice Samples

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Thirty brown rice samples were collected from the paddy field in the North and Northeast of Thailand. Ten white rice samples were purchased from the supermarket in Bangkok. The rice samples were ground to powder and dried in the electric oven at 60 °C until constant weight. 0.5 g of the dry samples was digested with the nitric acid (65%) and hydrofluoric acid (48%). The digested samples were determined for the concentrations of Cu, Fe, Mn and Zn by inductively coupled plasma atomic emission spectrometry (ICP-AES). For the quality control, the reference material of rice flour (NIST, 1504a) was used to check the accuracy of the analytical method. The analytical results showed good agreement with the certified values. The order of the mean concentrations was Mn > Zn > Fe > Cu for brown jasmine rice and Zn > Mn > Fe > Cu for white jasmine rice, respectively. The concentrations ranged from 1.08-2.32 mg Cu kg⁻¹, 6.58-10.3 mg Fe kg⁻¹, 20.4-41.8 mg Mn kg⁻¹, and 18.2-27.6 mg Zn kg⁻¹ for brown jasmine rice and 1.42-1.62 mg Cu kg⁻¹, 5.24-9.08 mg Fe kg⁻¹, 8.34-9.59 mg Mn kg⁻¹, and 21.0-22.9 mg Zn kg⁻¹ for white jasmine rice, respectively.

Keywords Micronutrient; Brown rice; White rice; ICP-AES
Antioxidative Activity from Ficus fistulosa reinw.

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Ficus fistulosa reinw. is a plant belonging in Moraceae family. They are a domestic of various regions of Thailand including Nakhon Si Thammarat. The part of them; fruit, root and peel stems have an effect of herb. In addition, the fresh fruit was a favorite vegetable that consumed with chinese noodle. The antioxidative activity and total phenolic content from Ficus fistulosa reinw. were studied. The crude methanolic extracts from part of Ficus fistulosa reinw.; fresh fruits, dry fruits, fresh root, dry root, fresh peel stems and dry peel stems were reacted with standard free radical DPPH (1,1-diphenyl-2-picrylhydrazyl). The optical density was detected by UV-VIS spectrophotometer at 515 nm. The results were calculated as an inhibitory concentration at 50% (IC$_{50}$ mg/L±S.D.) using ascorbic acid as a reference compound (IC$_{50}$ = 4.64 mg/L±6.14). As the result, in the dry fruit exhibited the highest antioxidant activity with IC$_{50}$ of 3.52 mg/L±13.06 followed by fresh fruits with IC$_{50}$ = 4.05 mg/L±16.20, dry root with IC$_{50}$ = 5.29 mg/L±8.34, fresh root with IC$_{50}$ = 6.89 mg/L±11.08, dry peel stems with IC$_{50}$ = 8.99 mg/L±9.05 and fresh peel stems with IC$_{50}$ = 10.98 mg/L±8.00. Total phenolic content in the methanol extracts showed that the dry fruit exhibited the highest total phenolic content (4.52 mg GAE/100 g ± 14.11 of dry weight), while the dry root had the lowest (0.08 mg GAE/100 g ± 12.95 of dry weight). The results suggests that Ficus fistulosa reinw. is a good sources of natural antioxidants and farther studies should be undertaken for their pharmacological properties.

Keywords Antioxidative Activity; DPPH assay; Total phenolic; Ficus fistulosa reinw.
Quantitative of Gamma-oryzanol and Total Lipid in the Local Glutinous Rice Bran from Thailand Northern Area using Adsorption coefficient technique

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Rice bran oil contains high level of several phytochemicals, i.e. gamma – oryzanol which is a complex ester of ferulate esterfied with sterols or triterpene alcohols. This research studied the extraction and analyzation of gamma-oryzanol and total lipids in rice bran of the Northern of Thailand glutinous rices; which were Gorkhor 6, Sanpatong 1, Maejo 2, Maejo 4 and Maejo 6 rice varieties. The primary qualification of gamma-oryzanol and total lipids from crude rice bran oil were quilitated by thin-layer chromatography. Adsorption coefficient (K) was used to determine gamma-oryzanol content in the bran under equilibrium extraction time with organic solvent extraction. The amount of gamma-oryzanol and total lipid quantity depend on the breed. The highest gamma-oryzanol content was found in Sanpatong 1 varieties. The result of gamma-oryzanol composition extraction was compared to commercial edible rice bran oil which was analyzed by high performance liquid chromatography. The four main components of gamma – oryzanol derivertive in the brans are 24-Methylene cycloartenyl ferulate, Δ7 – Campestenyl ferulate, Campestenyl ferulate and Δ7 – Sitostenyl ferulate.

Keywords Adsorption coefficient (K); gamma-oryzanol; glutinous rice bran varieties
Impact of Betel Harvesting Season on Chemical Profiling of Allylpyrocatechol and eugenol

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The harvest effect of Supercritical Fluid Extraction (SFE) extracts on quality of betel-leaf extracts (Piper Betle Linn.) has been reported. A high performance liquid chromatographic (HPLC) method was used for quantitative determination of Allylpyrocatechol (APC) and Eugenol in SFE extracts of Piper betle L. The SFE extract from betele leaves harvested in late rainy season showed the highest amount of APC and the lowest amount of eugenol in contrast to those harvested in summer period. The results indicated that harvest date effected on composition of betel-leaf extracts. This study underlines the water supply impact in each season could cause biosynthesis in betel leaves, especially those in propenylphenol derivatives.

Keywords Piper Betle Linn.; Allylpyrocatechol; eugenol; Harvesting season; HPLC
In Vitro Fermentation of Alkaline Extracted Hemicellulose from Khao Dawk Mali 105 Rice Bran by Probiotic Bacteria

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Rice bran is a by-product derived from the outer layer of brown rice in milling process. Rice bran contains hemicellulose which can be extracted by alkaline solution. The objective of this research was to assess the prebiotic potential of both hemicellulose and xylanase-treated hemicellulose from Khao Dawk Mali 105 rice bran. Each strain of lactic acid bacteria (Lactobacillus casei, Lactobacillus lactis and Lactobacillus plantarum) was grown in MRS mediums containing 1% (w/v) of three different carbon sources; glucose, hemicellulose, and xylanase-treated hemicellulose. At the initial stage, the probiotics grew more rapidly in glucose than both of hemicelluloses. However, cell number of probiotic in glucose decreased at 48 hours; while, those in both hemicelluloses were constant. Moreover, L. plantarum was obtained the growth in glucose better than in both hemicelluloses. Total acid and pH value during fermentation of hemicellulose slightly changed in primary stage and then was stable. In contrast, total acid and pH value during fermentation of glucose dramatically increased and decreased, respectively. The prebiotic activity scores of both hemicelluloses were also evaluated in this study. This value was calculated by the comparison between cell numbers grown in 24 hours of probiotic and Escherichia coli. The prebiotic activity scores of both hemicelluloses in three probiotic strains were not different from that of inulin. According to its highest growth rate, Lactobacillus plantarum could grow on inulin, xylanase-treated hemicellulose, and hemicellulose with the prebiotic activity scores of 0.41±0.05, 0.39±0.08, and 0.34±0.03, respectively.

Keywords Hemicellulose; Rice bran; Probiotic bacteria; Prebiotic activity score
A Comparative Study of the Properties and the Amount of Chitosan Extracted from Shell of Whiskered Velvet Shrimp and Mantis Shrimp

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The properties and the amount of chitosan extracted from 2 types of shrimp shells; whiskered velvet shrimp and mantis shrimp, were studied and compared. The chitosan extraction from both of shrimp shells procedure started with minerals elimination by using 1.0 M of HCl (1:20 w/v) and followed by protein elimination and pigment elimination using 2.0 M of NaOH (1:20 w/v) and 95% ethanol, respectively. After that the deacetylation process was applied by using 50% w/v NaOH to get a certain amount of chitosan. The degree of deacetylation of whiskered velvet shrimp and mantis shrimp were 82.976 and 80.350, investigated by using FTIR technique, and the moisture content of whiskered velvet shrimp and mantis shrimp were 10.78 and 11.44% respectively. The absorptions of heavy metals; Pb and Cr, of extracted chitosan were also studied. The absorption efficiency of Pb and Cr were found to be 89.45% and 70.07% for whiskered velvet shrimp and 89.45% and 65.71% for mantis shrimp.

Keywords Chitosan, Mantis Shrimp, Whiskered Velvet Shrimp
Content of Cadmium and Lead in Chicken samples from Nakhon Si Thammarat Fresh-Food Markets

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The content of cadmium and lead in chicken samples from fresh-food markets, Nakhon Si Thammarat, the south in Thailand, were determined. The chicken samples were collected from some markets in Mueng district, Thungsong district, Sichol district and Huasai district and determined by Atomic Absorption Spectrophotometry. It was found that cadmium content was found at 0.01 to 0.04 mg/L, 0.01 to 0.03 mg/L, 0.01 to 0.02 mg/L and 0.01 mg/L, respectively and lead content was found at 0.01 to 0.04 mg/L, 0.02 to 0.07 mg/L, 0.01 to 0.04 mg/L and 0.01 mg/L, respectively. This research study can use as database for environmental and food safety.

**Keywords** cadmium; lead; chicken samples; fresh-food market
Total Phenolic Content and Antimicrobial Potential of Methanolic Extract from *Jatropha curcas* Linn. Fruit

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In this study, total phenolic content of the methanolic extract from *Jatropha curcas* Linn. fruit was evaluated to prove their effect on antimicrobial activity. Firstly, the dried sample of *Jatropha curcas* Linn. fruit was extracted with 60 % (v/v) methanol to obtain the crude methanolic extract. According to the study of Folin-ciocalteu method, total phenolic content of the extract was 7.04 mg/g as gallic acid equivalent. Additionally, the evaluation of antimicrobial activity of the extract was performed by using Disc diffusion method for screening of this activity. Micro-well dilution method was then used to determine the minimum inhibitory concentration (MIC) of the extract against seven economic plant disease bacteria. It was found that the crude methanolic extract exhibited the potencies of antimicrobial activity against *Pseudomonas putida*, *Pseudomonas syringae* pv. *sesami*, *Xanthomonas campestris*, *Xanthomonas campestris* pv. *glycines*, *Xanthomonas campestris* pv. *vesicatoria* and *Ralstonia solanacearum* with the presence of inhibition zone. The crude methanolic extract showed potential for antimicrobial activity with inhibition zone in the range of 7.0-13.7 mm and MIC value at 214.29 µg/mL. As the results, the phenolic compound contained in the extract exhibited antimicrobial activities. Therefore, the finding of this study indicated that *Jatropha curcas* Linn. fruit has had potential as effective antimicrobial sources. Especially, the chemical compounds in *Jatropha curcas* Linn. fruit may be important for its application in clinical medicine in the future.

**Keywords** *Jatropha curcas* Linn. fruit; Total phenolic content; Antimicrobial activity; Disc diffusion method; Micro-well dilution method
Evaluation of Sugar Content in Some Commonly Consumed Northeast Thai Vegetables

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Plants and vegetables contribute significantly to the diets of northeast Thais, especially in the rural countryside. Not only the source of antioxidants and phenolic compounds, they are also the important source of nutrients, e.g. sugars, lipids, vitamins and minerals, which related to human metabolism and health. Some sugars act as energy source whereas the others play role in structure of plant cells. The aim of this study is to explore sugar content of edible vegetables in northeast Thailand. Nine fresh vegetable samples, including Azadirachta indica A.Juss., Basella alba L., Caesalpinia mimosoides Lamk, Careya sphaerica Roxb., Cratoxylum formosum Dyer, Limnophila geoffrayi Bonati, Schinus terebinthifolius and Syzygium gratum (Wight) S.N. Mitra were extracted with distilled water. Sugar analysis was done by specific chemical methods including anthrone, Benedict’s test, Saliwanoff’s test and Bial’s test. Starch was determined by iodine reaction. The results show that most of the studied vegetables composed of reducing sugar. Garcinia cowa Roxb. had the highest glucose content (0.416±0.008 mg/g fresh weight), followed by Basella alba L. and Schinus terebinthifolius (0.326±0.003 and 0.283±0.010 mg/g fresh weight respectively). Only Basella alba L. gave positive test with iodine, which indicated the presence of starch. This study revealed that these vegetables are alternative source of bio-nutrients for northeast Thais.

Keywords: Antioxidant, Sugar, Vegetable, Northeast Thailand
Oxalate and Fluoride Content in Selected Thai Herbal Teas

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Herbal tea has health benefits because of its antioxidant property which related to reducing risk of several diseases including cancer, coronary heart disease and hypertension. This tea also contain minerals such as fluoride (<4 ppm) which can prevent dental carries. Despite the health advantages, oxalate in herbal tea can cause renal stone formation that usually found in northeast Thais. The objective of this study is to determine oxalate and fluoride content in 19 commercial Thai herbal teas. The aqueous extracts of the selected teas were evaluated for oxalate by colorimetric analysis. Fluoride content was measured by ion-selective electrode. The results showed that the highest level of oxalate was found in the herbal tea extract of Carthamus tinctorius Linn., followed by Phyllanthus amarus Schum. & Thonn., Aloe vera Linn. and Thunbergia laurifolia Linn. (4.74±0.10, 2.62±0.04, 2.08±0.01, 2.06±0.06 mg/g of tea respectively). The lowest oxalate content was found in Ganoderma lucidum (Leyss.ex. Fr) Karst. (1.26±0.01 mg/g of tea). Fluoride content in the herbal tea extracts ranged from 0.053 to 0.134 ppm. Ginkgo biloba L. and Carthamus tinctorius Linn. teas exhibited the high level of fluoride (0.134, 0.114 ppm, respectively). The present study suggested that consuming high amount of herbal teas per day should be considered and indication of oxalate and fluoride concentration on tea products may give advantage to consumer.

Keywords Oxalate; Fluoride; Herbal teas
Spectrophotometric Determination of Chlorophyll, β-carotene and Anthocyanin from Local Plants in KamphaengPhet Provinces

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Chlorophyll a, chlorophyll b, β-carotene, and anthocyanin were determined in ten local plants in KamphaengPhet province, including SauropusandrogynusMerr, TiliacoratriandraDiels, Amaranthuslividus, Cratoxylumformosum (Jack) Dyer ssp.Pruniflorum (Kurz.)Gogelin, MomordicacharantiaLinn, Passifloraoeotida Linn, Glinusoppositifolius A. DC., Basella albaLinn, ColubrinaasiaticaBrongn., and Clitoriaternatea Linn. Water, dimethyl sulfoxide (DMSO), and ethanol were used as extraction solvent for chlorophyll a and chlorophyll b. Hexane: acetone (6:4; 8:2; 10:0) was used as extraction solvent for β-carotene and anthocyanin. Spectrophotometric measurements were carried out at wavelengths of 645, 663, 436 and 535 nm for chlorophyll a, chlorophyll b, β-carotene, and anthocyanin, respectively. The amount of chlorophyll a in Clitoriaternatea Linn with water at 3 hr, and chlorophyll b in ColubrinaasiaticaBrongn. with ethanol at 5 hr, β-carotene in TiliacoratriandraDiels and anthocyanin in Passifloraoeotida Linn with hexane:acetone (6:4) at 3 hr, were found to be the highest.

Keywords: Spectrophotometric determination; Chlorophylla; chlorophyllb; β-carotene; anthocyanin; Local plants
Comparison of the Nutritional Value of Mushroom Folk

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A comparison of the nutritional value of five indigenous mushroom species; (Boletus mushrooms, Boletus griseipurpureus, Palm mushroom, Schizophylum commune Fr and Termite Mushroom) has been evaluated. Protein and cellulose contents were determined both fresh and dry mushrooms. which were carried out at 50 °C Boletus mushrooms was found the highest amount of protein (0.50 µg/mL). The lowest protein was found in palm mushrooms (0.008 µg/mL) in fresh condition. whereas it had the highest protein (0.60 µg/mL) in dry condition. Termite mushrooms contained (0.08 µg/mL) which was the lowest amount of protein in dry condition. Cellulose content showed the highest amount in Boletus mushrooms (2.52%), while Schizophylum commune Fr (0.03%) had the lowest in fresh condition. The highest cellulose was found in Boletus griseipurpureus (13.97%) and Boletus mushrooms contained the lowest cellulose (6.42%) in dry condition. This result derived important nutritional information five mushrooms wildly consumed in South of Thailand.

Keywords: Nutrition; Mushroom folk; Mushroom
Study on Antioxidant Activity of Local Vegetables in Loei Province

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The objective of the study on antioxidant activity of local vegetables in Loei province were:
1) to study the solvent used to extract the antioxidants in the vegetables,
2) to study of the antioxidant properties of vegetables by Spectrophotometry by IC_{50},
3) to compare the antioxidant activity of vegetables with ascorbic acid. The local vegetables 15 samples include
Ocimum sanctum L, Ocimum basilicum L, Coccinia grandis L, Piper sarmentosum Roxb.ex Hunter, Ocimum basilicum Linn., Morinda citrifolia L, Syzygium gratum (Wight) S.N. Mitravar.gratum, Cratoxylum formosum(Jack.) Dyer., Dryopteris amboinensis Ktze. F, Lasia spinosa Thw, Acmella oleracea L, Sauropus androgynus, Momordica charantia Linn, Careya sphaerica Roxb and Acacia Insuavis, Lace. The experiment was designed which divided to 2 steps. Firstly, the solvent used to extract the antioxidants. Secondly, the study of properties of antioxidants in vegetables by DPPH measuring the absorbance at 517 nm then compare the IC_{50}. The results showed that suitable solvent for the extraction of antioxidants is methanol and antioxidant properties of local vegetables found that the antioxidant activity of vegetables. The IC_{50} values with Syzygium gratum (Wight) S.N. Mitravar.gratum, Careya sphaerica Roxb, Sauropus androgynus, Cratoxylum formosum(Jack.) Dyer, Coccinia grandis L, Ocimum basilicum L, Ocimum sanctum L, Ocimum basilicum Linn, Acacia Insuavis, Lace, Lasia spinosa Thw, Momordica charantia Linn, Morinda citrifolia L, Piper sarmentosum Roxb.ex Hunter, Dryopteris amboinensis Ktze. F and Acmella oleracea (L.) were 0.9575, 1.1083, 1.1375, 1.1400, 2.0254, 2.4428p, 4.9130, 5.1460, 8.5540, 10.5890, 11.5190, 21.9227, 22.4558, 38.6240 and 120.825 mg / ml respectively.

Keywords: antioxidant, local vegetables
The Effects of Soaking on Increase Gamma Amino Butyric Acid (GABA) Content in Brown Germinated Upland Rice

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This research aimed to study, The effects of soaking on increase gamma amino butyric acid content in brown germinated upland rice with it’s the purpose were: 1) To determine the soaking time on GABA contents in brown germinated upland rice, 2) To contents analysis and comparison of GABA in the upland rice species and keep on 6 months by soaking rice six species. Including the big grain sew gliang daeng (GR1), small grain sew gliang daeng (GR2), Pla Sew Khaw (GR3), Black glutinous rice (GR4), Pla sew Noi (GR5), Prae(R4) Sew Gliang Khaw(R5) and New pla sew Noi (GR6) in water controlled at pH 6 and 40 °C at the different soaking times 12 and 24 hour, and then germinated at room temperature for 24 and 48 hours. They were steamed and dried at 55 °C for 15 minutes. The content of GABA was analyzed of GABA derivatives. GABA was derivatized with boron trifluoride in methanol (BF₃MeOH) and 9-Fluoronyl methyloxychloroformate (FMOC-Cl) and then measured using HPLC. The results showed that soaking time and germination of brown germinated upland rice at 12 hours, to grow for 48 hours the amount of GABA in rice GR3=401.3938±2.1254, GR5=474.1463±0.4869 and GR6=473.8087±0.0093 mg/kg, respectively. The highest content of GABA compared with other condition of soaking time and germination were while other species did not observe even soaking time increased to 24 hours to grow for 48 hours. With increase in the contents of GABA as follows GR1=264.7797±0.2764, GR2=299.5069±2.0231 and GR4=465.1495±0.3779 mg/kg respectively. And brown germinated upland rice keep on 6 months, The amount of GABA from all of species slightly increased was 1.3787 to 6.6869%.

Keyword Gamma amino butyric acid; Brown germinated upland rice; Soaking time
Detection of Electron-beam and Gamma Ray Irradiated Beans by Photo-stimulated Luminescence (PSL) Technique during Storage Time

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The use of photo-stimulated luminescence (PSL) technique was investigated to identify irradiated beans compared to the unirradiated samples during 6 months of storage. The 4 kinds of Thai beans used on dried seeds were peanuts, soybeans, mung beans and black beans. The radiation types treated on those beans were electron beam and gamma ray at the dosages of 1, 5 and 10 kilo grays. The results showed that the PSL technique gave absolutely correct measurements on 4 kinds of unirradiated samples (negative signal display < 700 counts/60s). It was also the correct results through 6 months of storage in all irradiation dose treatments of peanuts and soybeans including those of 10 kGy irradiated mung beans (positive signal display > 5000 counts/60s). The greater signals of all kinds of beans were counted with the higher dose treatments in each month of analysis. The signals of intermediate results (700-5000 counts/60s) were shown on both of radiation treatments of mung beans irradiated at 1 kGy and black beans irradiated at 5 and 10 kGy. The positive signals were resulted on the correct measurements on the 5 kGy e-beam and gamma ray irradiated mung beans after 1 and 2 months of storage time, respectively. After that the signals decreased to the intermediate results. The 1 kGy irradiated gamma ray black beans did not show correct measurements on PSL (false negative results) since after irradiation treatment. Therefore, the applications of PSL technique on irradiated dried beans should be more considered in their detection on some kinds of bean, the type of radiation treatment and the period of time between irradiation processing and analysis.

Keywords: Photo-stimulated luminescence (PSL); Beans; Electron radiation, Gamma radiation
Determination of Vitamin E in Thai Rice By High Performance Liquid Chromatography

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The aim of this research was to determine the content of vitamin E in different three varieties of Thai rice samples (e.g., Dokkam, Lebnok and Gadamtondam) using high performance liquid chromatography (HPLC). The samples were prepared by extraction with methanol. The optimum HPLC conditions were Inertsil ODS – 3 (5µm, 4.6 ×250 mm.) working column, 100% (v/v) methanol as the mobile phase and UV detection at 295 nm. The injection volume of 20 µL, a flow rate of 2.0 mL/min and temperature at 40 °C, were used. Under these condition, vitamin E was eluted at 6.955 min. The linear calibration curve was obtained in the range of 10.00 - 100.00 mg/L with the correlation coefficient of 0.9980 (n = 5). The limit of detection was at 0.50 mg/L and the percentage (n = 10) recoveries were in the range of 98.15 – 99.70 % at the spiked concentrations of 10.00, 50.00 and 100.00 mg/L. The content of vitamin E in brown rice of Dokkam, Lebnok and Gadamtondam Varieties were found to be 277.59, 205.21 and 369.89 mg/kg, respectively. Meanwhile, it was found to be 501.33, 188.54 and 429.99 mg/kg in bran samples of Dokkam, Lebnok and Gadamtondam Varieties, respectively.

Keywords Vitamin E; Thai rice; High Performance Liquid Chromatography
Effect of Heating Temperature and Storage on the Stability of Coconut Oil with Extracted Zingiber and Curcuma

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Zingiber and curcuma were herbs. These herbs can be used as medicine, cosmetic and healthy food because zingiber and curcuma contain high total phenolic compounds which are a powerful antioxidant. The aim of this study is to produce coconut oil with extracted zingiber (COZ), coconut oil with extracted curcuma (COC) and virgin coconut oil (VCO). The oxidative stability, the antioxidant activity (% AA), chemical property, free fatty acid (FFA), peroxide value (PV) and total phenolic compounds were determined. It was found that FFA of COC, COZ and VCO were 0.153, 0.194 and 0.249 respectively. It was found that PV of COC, COZ and VCO were 1.948, 0.974 and 3.245 respectively. It was found that % AA of VCO, COZ and COC 150 min were 41.595, 50.979 and 57.448 respectively. It conclusion coconut oil with extracted curcuma highest total phenolic content and oxidative activity and it can more the inhibitory on DPPH radical than coconut oil with extracted zingiber and virgin coconut oil respectively because it lowest free fatty acid, peroxide value. The results of this study might be used as a good source of natural antioxidant compounds.

**Keywords** Zingiber, Curcuma, Coconut Oil, Phenolic Compound
Uptake of Silicon by Rice Grown under Specific Hydroponic Conditions

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Plants take up silicon into their bodies through roots in the form of soluble silicic acid. The silicic acid polymerizes to form intracellular or extracellular silica bodies in certain plant organs. It is well accepted that silica renders strength to the stalk and stem of plants, particularly those in the Poaceae family, helping to toughen stem and widen the leaves of those plants. Additionally, silica accumulated in seed outer layers to give protection to delicate parts inside. There is accumulating evidence indicating that silica also guards against the attack by pests and fungi and offers protection to plants from stresses. We are interested in the ability of rice, Oryza sativa, to uptake silicon under hydroponic conditions spiking with different concentrations of silicic acid. It was found that rice accumulated silicon well in the form of silica bodies in stems, leaves, and seed outer coats. Using scanning electron microscope equipped with an energy dispersive X-ray spectrometer (SEM-EDS) we found the silica bodies distributed uniformly in regular patterns on the surface of rice leaves, having a unique shape similar to dumbbell. The characteristic X-ray in the form of Kα line confirmed the presence of Si in those bodies. The silica bodies have an overall length of about 15 µm. Chemical analysis using the rapid microdetermination technique which measured Si reaction products spectrophotometrically at 810 nm confirmed the uptake of Si into rice under the hydroponic grow-out conditions.

Keywords Oryza sativa; hydroponic; silica body; SEM-EDS; characteristic X-ray
Antioxidant Activity, Total Phenolic Compounds and Chemical Components of Traditional Thai Rice

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In the present study, the antioxidant activities of traditional Thai rice were reported. The five selected rice code T1-T5 were extracted by hexane, ethyl acetate and methanol. The antioxidant activities were elucidated using DPPH and ABTS methods. The antioxidant activities of the methanol crude extract T1 was found the highest antioxidant activity with 68.61 and 99.52%, respectively. The results of reducing antioxidant power (FRAP) assays showed that T1 and T4 were high at 1,419.69 and 1,294.91 mg L-Ascorbic acid equivalent, respectively. These results clearly indicate that methanol crude extract of T1 has the highest antioxidant activity. In addition, the total phenolic content of methanol crude extract of T1 was investigated. The total phenolic content for methanol T1 extract using Folin-Ciocalteu reagent was 63.07 mg/g. The chemical compositions of methanol crude extract of T1 were analyzed by the column chromatography and NMR spectroscopy. Linoleic acid and sucrose sugar were found in methanol crude extract of T1.

Keywords Traditional Thai rice; Antioxidant activity; Total phenolic compound; crude extract; Linoleic acid
Total Phenolic and Antioxidant Activity of Glutinous Rice from Ubonratchathani and Amnat Charoen Provinces

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Glutinous rice is the main food for people in north eastern part of Thailand. Varieties of glutinous rice have been grown. In the present study, nine glutinous rice codes GR1-9 were selected from Ubonratchathani and Amnat Charoen province were extracted by hexane, ethyl acetate and 95% methanol. To investigate the antioxidant activity of twenty-seven crude extracts, DPPH, ABTS and reducing antioxidant power (FRAP) assays were performed. The obtained results clearly indicate that the methanol crude extracts showed higher anti-oxidant activity than hexane and ethyl acetate crude extracts. The results obtained from DPPH assay, the glutinous rice code GR4 show the highest anti-oxidant activity with 93.34 % inhibition. For ABTS assay, the glutinous rice code GR3 and GR4 gave the inhibition percentage of 52.11 and 59.92, respectively. For the reducing antioxidant power of crude extract compounds based on FRAP assay, the high values were found in the crude ethyl acetate and hexane extracts of GR7 and methanol extract of GR5 (FRAP Value 3,056.17, 2,722.22 and 2275.51 mg L-Ascorbic acid equivalent, respectively). The total phenolic content for methanol GR4 extract using Folin-Ciocalteu reagent was 59.63 mg/g. Moreover, the chemical compositions of methanol crude extract of GR4 were investigated by column chromatography and NMR spectroscopy. The results clearly indicate that Linoleic acid, Palmitic acid and Myristic acid were found in G4 methanol crude extract.

Keywords Glutinous rice; Antioxidant activity; Total phenolic compound; Column chromatography; crude extract
Using Activated Carbon derived from Local Agricultural Residues for VOC Removal from Wastewater

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Volatile organic compounds (VOCs) are organic compounds that easily become vapours or gases. Typical VOCs can cause eye, nose and throat irritation. Long-term exposure to certain VOCs can lead to more serious health impacts. They can present in the urban and industrial atmosphere originated from combustion processes, and also in the wastewater from the municipality and the industrial area mainly from the petrochemical industry in which the VOCs generally used as a chemical solvent. One of the most widely used methods to remove VOCs from wastewater is the activated carbon adsorption due to high efficiency and low cost. Therefore, in this study the activated carbon derived from the selective local agricultural residues was investigated for its feasibility to use as an adsorbent in wastewater treatment. Shell-based activated carbons were prepared from horn chestnut, peanut, coconut and sugar palm through thermal activation process with or without chemical treatments. The raw materials were investigated by X-ray fluorescence (XRF) for a surface analysis to gain a deeper understanding of the relation between the surface properties of the precursor and the obtained product. The high amount of chlorine (Cl) and sulphur (S) existed in the horn chestnut shell as observed from the XRF may induce corrosion problem of adsorption systems, and thus it should be one factor to be considered when using as an adsorbent. The VOCs adsorption capacity of the activated carbons was determined using o-xylene, benzene, chloroform and carbon tetrachloride as contaminants in the prepared-water samples, and high performance liquid chromatography (HPLC) to detect the final concentration of the VOCs in the samples after being treated with the activated carbon. The results revealed that the activated carbon prepared from the local agricultural residue can be comparable to the commercial one for the VOCs water treatments.

Keywords Activated carbon; Volatile organic carbon (VOC); Adsorption
\textbf{1H-NMR Fingerprinting of Cold-Pressed Rice Bran Oil}

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The effect of cold-pressed rice bran oil on quality was investigated. Indices like acid value, peroxide value and saponification value play a significant role in quality control and identification of lipids. Requirements on these parameters are specified by the monographs of the European pharmacopeia. 1H-NMR spectroscopy provides a rapid and simple alternative to these classical approach. The presence of 1H-NMR signals of diglycerides and monoglycerides indicates that some hydrolytic degradation of the rice bran oil had started. This study underlines the impact of small and medium enterprise productions on quality of cold-pressed rice bran oil using 1H-NMR fingerprint as a chemical fingerprint, or “signature,” of rice bran oil samples.

**Keywords** NMR; fingerprinting; rice bran oil; cold-pressed
Formulated Insoluble Powder of Neem Oil via Spray Drying

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Insoluble microcapsule of β-cyclodextrin containing neem oil in the presence of azadirachtin-A were prepared by spray drying for photodegradation resistance and control release at desired condition. The mixture of neem oil in the carrier solution of β-cyclodextrin were first prepared to give a total content of oil and solid of 20, 30 and 40%wt and left sample. To produce the insoluble microcapsule, the mixture was mixed with ethylene acrylic acid at 50 ºC before fed through spray drying. The solution was polymerized during spray drying process. The centrifugal and nozzle atomizer of spray drying were used to evaluate the effect of powder size to control release characteristic. The remaining of azadirachtin-A in the powder were measured. The water solubility and morphology of spray-dried powders were also investigated. The result demonstrated that larger powder size reduced releasing rate of azadirachtin-A. The morphology of surface powder after soaking in medium is rougher than undissolved powder due to some part of cyclodextrin dissolving. The polymerized microcapsule was poorly soluble after soaking in aqueous medium resulted in the decreasing of the microcapsule solubility.

Keywords Neem oil; Spray dry; Insoluble power; Control release