

## Novel Laboratory Recycled Water Distillation System

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Nowadays, the consumption of water has grown greatly due to an increase in numbers of users in our laboratory. Thus, it is very essential to conserve water. A commercial water distiller (Pobel, Spain) system has been used to produce purified water for our laboratory. It consists of a filter where tap water enters and is filtered, a boiling chamber with a heat controller where the filtered water is heated and vaporized, a condensing coil where the water is cooled and converted back to reusable water, a drain where water is discharged and stored in the container as purified water. Production rate is quite low about 16 liters per day (8 hrs), and water loss is approximately 960 liters per day. To save this amount of water, an addition of four storage tanks was established. Major modification of the existing system involved diversion of treated hot water (80°C) from the drain into the first tank. In this tank, the water was cooled down before being discharged to the second, the third and the fourth tanks, consecutively. Occasionally, the make-up water, filtered water, was added in the third tank. Finally, the water was delivered into a boiling chamber. This repeatable step provided an increase in water production rate by 25% compared with the value obtained from the existing system.

**Keywords** Distilled water; Recycled water; Water conservation

## Antioxidant Activities of Crude Methanolic Extract of *Nephelium ramboutan-ake* (Labill.) Leenh. Peel

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*Nephelium ramboutan-ake* (Labill.) Leenh., Ngoh-khonsan in Thailand, is tropical species that is cultivated in Southeast Asia. The juicy, sweet pulps of its fruits are usually consumed fresh. In addition, its root has been used in traditional medicine for antihelmintic and antipyretic. In this research, the plant material was collected from East Kalimantan of Indonesia and antioxidant activities of crude methanolic extract of fruit peel were evaluated using five different methods including 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, hydroxyl radical scavenging assay, hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) scavenging assay, ferric ion reducing power assay, and ferrous ion chelating assay. Ascorbic acid was taken as standard. The total phenolic content (TPC) and total flavonoid content (TFC) of the plant extract were also determined using Folin-Ciocalteu and aluminum chloride method, respectively. The hydrogen peroxide scavenging activity of the plant extract was found to be slightly higher than that of ascorbic acid. The capability of scavenging DPPH radical and ferric ion reducing power of the plant extract were slightly less than those for ascorbic acid. On the other hand, the plant extract possessed less antioxidant activity against hydroxyl radical as compared with ascorbic acid and exhibited less ferric ion chelating capability than EDTA. TPC and TFC of the plant extract were found to be  $306.0417 \pm 0.6505$  mg gallic acid equivalent/g crude extract and  $14.0494 \pm 0.1413$  mg quercetin equivalent/g crude extract, respectively.

**Keywords** *N. ramboutan-ake*; Antioxidant activity; Phenolic content; Flavonoid content

## **Antioxidant Activity and Antioxidant Content of Fresh Water Red Algae**

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Fresh water red algae have been applied in many industries such as supplementary for human and animal, dye in food, cosmetics, and drug because it has high antioxidant content such as total phenolic content and total carotenoid content. This work was aimed to study antioxidant activity and antioxidant content such as total phenolic content and total carotenoid content in dried fresh water red algae. Dried fresh water red algae were extracted by methanol. The total phenolic content and total carotenoid content in dried fresh water red algae was found to be 9.60 mg/100 g (expressed as Gallic acid equivalent) and 26,300 mg/100g of dried fresh water red algae, respectively. Antioxidant activity was studied by DPPH method. Antioxidant activity of 800 ppm crude extract from dried freshwater red algae was found to be 81% at 150 min, which showed slightly lower than BHT (99%). Result revealed crude extract from dried fresh water red algae with high antioxidant content has high antioxidant activity.

**Keywords** Fresh water red algae, Antioxidant activity, total phenolic

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## Study of Antioxidant Activity of Coconut Oil with Extracted *Artocarpus*'s Core for Skin Care Product

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Core of *Artocarpus* as herbs contain oxyresveratrol which is a powerful antioxidant. It can be used anti-aging agent, skin-whitening agent, and anti-oxidant. Coconut oil with extracted *Artocarpus*'s core can be used in cosmetic industry. This work aimed to study antioxidant activity using 2, 2-Diphenyl-1-picrylhydrazyl radical (DPPH) of coconut oil with extracted Core *Artocarpus* as compared with virgin coconut oil. Coconut oil with extracted *Artocarpus*'s core was produced by different ratio of coconut meat and core of *Artocarpus* of 2 kg: 10 g, 2 kg : 20 g, 2 kg : 30 g and 2 kg : 40 g. It was found that the percentage of inhibition of virgin coconut oil and coconut oil with extracted *Artocarpus*'s core in ratio of coconut meat and core of *Artocarpus* 2 kg : 10 g, 2 kg : 20 g, 2 kg, : 30 g and 2 kg : 40 g were 23%, 31%, 35%, 38% and 50% at 180 minute, respectively. Results showed that antioxidant activity of coconut oil with extracted *Artocarpus*'s core depend on the content of *Artocarpus*'s core. It was concluded that coconut oil with extracted *Artocarpus*'s core with high antioxidant, was more higher antioxidant activity than virgin coconut oil. Coconut oil with extracted *Artocarpus*'s core can be applied to skin care product.

**Keywords** Core of *Artocarpus*; Oxyresveratrol; Antioxidant activity

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## **Antioxidant Activity and Total Phenolic Compounds of Coconut Oil with Extracted Pulp Gac Fruit (*Momordica cochinchinensis* Spreng)**

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Gac fruit (*Momordica cochinchinensis* Spreng) had high  $\beta$ -carotene, lycopene and total phenolic content, which make it a powerful antioxidant. Coconut oil with extracted Gac fruit enriched with these antioxidants can be used in cosmetics and supplements. This study aimed to investigate total phenolic content and 2,2 – Diphenyl-1-picrylhydrazyl radical (DPPH) scavenging activity of coconut oil with extracted Gac fruit were studied by using different ratio of coconut meat to pulp of Gac fruit 3 kg : 25 g , 3 kg : 50 g and 3 kg : 100 g and compared with virgin coconut oil. It was found that total phenolic content in virgin coconut oil and coconut oil with extracted pulp Gac fruit in ratio of coconut meat to pulp Gac fruit into 3 kg : 25 g , 3 kg : 50 g and 3 kg : 100 g were 31.296 , 82.856 , 155.395 and 243.379 mg gallic acid equivalent/100 g oil , respectively. DPPH radical scavenging activity of virgin coconut oil and coconut oil with extracted pulp Gac fruit in ratio of coconut meat to pulp Gac fruit in 3 kg : 25 g , 3 kg : 50 g and 3 kg : 100 g were 25.29% , 26.07% , 38.91% and 68.29% at 180 minute, respectively. Results revealed that total phenolic content and DPPH radical scavenging activity of coconut oil with extracted depend on the content of pulp Gac fruit. Coconut oil with extracted pulp Gac fruit in ratio of coconut meat to pulp Gac fruit into 3 kg : 100g gave the highest total phenolic content and antioxidant activity. It was concluded that coconut oil with extracted of pulp Gac fruit, which enriches phenolic compounds, was more potent antioxidant than virgin coconut oil.

**Keywords** Antioxidant activity; Phenolic; Gac fruit

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## Comparison of Total Phenolic Contents and Antioxidative Potential between *Basella rubra* and *Basella alba*

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*Basella rubra* and *Basella alba* are members of BASELLACEAE family and widely used as a leaf vegetable. Besides, all parts of these plants are traditionally used for the treatment of various ailments such as *anti-inflammatory*, increasing diuretic, and decreasing constipation. The objective of this research is to investigate the antioxidant activities by using DPPH radical scavenging assay and the total phenolic contents by using *Folin Ciocalteu* method between ethanolic extracts of *Basella rubra* and *Basella alba*. Based on the DPPH radical scavenging assay with a comparison to the standard antioxidant- BHT, the ethanolic extract of *Basella rubra* exhibited higher antioxidant activity than that of *Basella alba*. The percentage of DPPH radical inhibition for *Basella rubra* and *Basella alba* were 41.08 and 22.10 respectively. Furthermore, the total phenolic content of the ethanolic extract of *Basella rubra* was found to be higher than that of *Basella alba*. These outcomes can support the usage of *Basella rubra* and *Basella alba* as a Thai traditional medicine. In addition, *Basella rubra* has higher biological activity against prostat and breast cancer cell lines than *Basella alba*, therefore its antioxidative compounds should be isolated further in the future.

**Keywords** Antioxidant activity; Phenolic; *Basella rubra*; *Basella alba*

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## **Comparison of Antioxidant Activity and Total Phenolic Contents of Sawtooth Corianser (*Eryngium foetidum* L.), Oenanthe (*Oenanthe stolonifera* Wall.) and Dill (*Anethum graveolens* Linn.)**

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This study aimed to compare total phenolic contents and antioxidant activity of 3 edible plants of Thailand (Sawtooth Corianser, Oenanthe and Dill), which are high nutritional value. The fresh whole plants were extracted with methanol. The extracts were evaluated for total phenolic contents and antioxidant activity using Folin-Ciocalteu method and DPPH radical scavenging method, respectively. The results showed total phenolic contents of Sawtooth Corianser, Oenanthe and Dill were 914.88, 813.71 and 467.84 mg gallic acid equivalent/g fresh weight, respectively and IC<sub>50</sub> values of antioxidant activity of Sawtooth Corianser, Oenanthe and Dill showed 33.97, 50.97 and 60.24 µL, respectively. In addition, it was found that total phenolic contents of Sawtooth Corianser, Oenanthe and Dill related to their antioxidant activity.

**Keyword** Antioxidant activity; Dill; Phenolic content; Oenanthe; Sawtooth corianser

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## Phytochemical Screening and Bioactivity of *Angiopteris evecta* Leaves from East Kalimantan

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This study aimed to evaluate the bioactivity and screen the phytochemicals presenting in *Angiopteris evecta* leaves in East Kalimantan. *Angiopteris evecta* leaves were extracted by using methanol at room temperature. The methanolic extract from *Angiopteris evecta* leaf was studied for antibacterial activity (5 mg/mL of extract solution), an antioxidant activity (0.025 – 5 mg/mL) and anti-tyrosinase activity (0.3 – 1 mg/mL). Agar well diffusion method was used for identify the inhibition of pathogenic bacteria. Antioxidant was assessed using DPPH scavenging assay and OH radical-scavenging activity assay with ascorbic acid as positive control. Anti-tyrosinase was assayed spectrophotometricall using L-dopa, tyrosinase and kojic acid as substrate, enzyme and positive control, respectively. *Sallmonela thypi*, *Propionibacterium acnes*, and *Bacillus cereus* were chosen for testing the antibacterial activities of the plant extract. The results showed that *S. thypi* and *B. cereus* could be inhibited with the inhibition zone at  $11.00 \pm 1.02$  mm and  $10.30 \pm 0.00$  mm. Chloramphenicol was selected as positive control with inhibition zone  $22.67 \pm 0.79$  mm and  $20.00 \pm 1.15$  mm, the least concentration of the plant extract at 5 mg/ml. The results of testing antioxidant activities showed that the IC<sub>50</sub> value of DPPH radical scavenging assay was  $0.079 \pm 0.000$  mg/mL while that for OH radical-scavenging activity assay was  $3.483 \pm 0.09$  mg/mL. As compared to ascorbic acid, the plant extract showed slightly less antioxidant activity against DPPH. IC<sub>50</sub> value of the plant extract for anti-tyrosinase activity was found to be  $0.763 \pm 0.020$  mg/ml. The results of phytochemical screening confirmed the presences of active compounds, which were alkaloids, flavonoids, saponins, steroids, and carbohydrates, in the plant extract.

**Keywords** *Angiopteris evecta*; Antibacterial; Antioxidant; Phytochemical screening



## Antioxidant and Antimicrobial Activities of Crude Methanolic Extract of *Polyscias guilfoyle* Leaves

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The present study aimed to investigate the preliminary phytochemical analysis, antioxidant and antimicrobial activities of crude methanolic extract from *Polyscias guilfoylei* leaves. Preliminary phytochemical screening was carried out using standard methods. Its antioxidant activity was evaluated by using five different methods including DPPH radical scavenging assay, hydrogen peroxide scavenging assay, reducing power assay, Fe<sup>2+</sup> chelating assay, and hydroxyl scavenging assay. All methods were used ascorbic acid as a standard. Furthermore, the methanolic extract of *Polyscias guilfoylei* leaves was also tested for antibacterial activity by the agar well diffusion method. In preliminary phytochemical analysis the crude methanolic extract consisted of tannins and saponins. Total phenolic content of the methanolic extract was 10.36 mg gallic acid equivalent/g of plant extract. For the antioxidant activities, the result showed that, the activities of plant extract against DPPH, H<sub>2</sub>O<sub>2</sub>, and OH<sup>·</sup> radical were depended on the concentration with IC<sub>50</sub> value of 1.875, 1.325, and 2.7 mg/ml while those for ascorbic acid were 0.225, 0.275 and 0.225 mg/ml, respectively. Fe<sup>2+</sup> chelating activity of the plant extract was also found with IC<sub>50</sub> value about 0.875 mg/ml and that for ascorbic acid was 0.225 mg/ml. The Fe<sup>3+</sup> reducing power of the plant extract was 3.65 mg/ml and that for ascorbic acid was 0.25 mg/ml which were studied from absorbance at 0.500. The plant extract at the concentration of 5 mg/ml showed a promising activity against *S. thypii* with the size of inhibition zone of 10.0 mm, *P. acne* 9.3 mm and *B. cereus* 9.0 mm. Chloramphenicol was used as a positive control with the size of inhibition zone of 21.0 mm; 29 mm and 20.0 mm at the same concentration, respectively. Our findings provide important evidence that the methanolic extract of *Polyscias guilfoylei* is one promising source of natural antioxidants as well as antimicrobial agents.

**Keywords** *Polyscias guilfoylei*; Antioxidant activity; Antimicrobial activity; Total phenolic content

## Comparison of Antioxidant Activity and Total Phenolic Content of the Ginger, Finger Root and Curcuma White Juices

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The objective of this research was to compare the antioxidant activity and total phenolic content of rhizome juices belonging to the ZINGIBERACEAE family which were namely ginger (*Zingiber officinale* Roscoe), finger root (*Boesenbergia rotunda* (L.) Mansf) and curcuma white (*Curcuma* sp.) that have been used widely in health. The antioxidant activity was performed using 2, 2-diphenyl-1-picrylhydrazyl (DPPH) scavenging, and the total phenolic content was evaluated by Folin-ciocalteu method. The DPPH radical inhibition of ginger, finger root and curcuma white was  $76.76 \pm 4.69$ ,  $24.79 \pm 2.30$  and  $10.10 \pm 0.90$  %, respectively. In addition, the total phenolic content of ginger, finger root and curcuma were  $75.29 \pm 1.29$ ,  $58.99 \pm 0.50$  and  $43.85 \pm 2.5$   $\mu\text{g}$  gallic equivalent/g fresh weight, respectively. The result indicated that the percentage of DPPH radical inhibition was related to total phenolic content. The ratio of antioxidant activity to total phenolic content of ginger juice showed the highest activity; hence, the best natural source of antioxidant activity was ginger.

**Keywords** Ginger; Finger root; Curcuma white; Antioxidants; Total phenolic content

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## The Development of Concealer Formulations Based on Kaolin in Thailand

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This research is the development of concealer formulations based on Kaolin in Thailand. The unique properties of kaolin are precise mineral texture, rather white, able to endure with high temperature and also absorb oil. The purpose of this research is to expand concealer product by using kaolin in Thailand as ingredient in order to reduce the cost in formulations and also in production processes. The recipes produce cream type oil in water (o/w) concealer products with three different skin tones from white to dark brown. The quality and performance of the concealer product were evaluated for its stability (Heating & Cooling cycle at 4 °C and 45 °C), performance (50 volunteers), physiology (patch test), microbial (total colony count, *presumptive coliform*, *faecal coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Salmonella spp.* and *Clostridium spp.*) and heavy metal contamination (Atomic absorption spectrometer). This kaolin based concealer product shows smooth texture with well consistency of formulated matrix. The finished products are found to have pH in the range of 5.5-7 depending on cream compositions with good stability which it is appropriate to dry skin. Furthermore, there is no separation between layers of emulsion after setting on shelf for three months. Also, there is no contaminant of microbial and metal. The concealer is able to conceal effectively and there is no allergic effects were observed with volunteers. Therefore, the research can be concluded that Thai's kaolin can a good material for concealer production.

**Keywords** Kaolin; Cosmetic; Emulsions; Evaluation; Concealer

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# Fabrications of Lipid-based Nanocarriers (LBNs) loaded Alpha-Mangostin for Enhance Its Properties and Potential use in Drug delivery system

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Alpha-mangostin is one of the natural extract which possesses many activities such as anti-oxidant, anti-bacterial, anti-inflammatory and anti-cancer. However, their applications were limited due to its stability and solubility. In order to overcome this, lipid-based nanocarriers (LBNs) including solid lipid nanoparticles (SLN), nanostructure lipid carriers (NLC) and nanoemulsion (NE) were fabricated and entrapped  $\alpha$ -mangostin in their particles to protect  $\alpha$ -mangostin properties from the extreme conditions. Meanwhile ratio of lipid phase and  $\alpha$ -mangostin were evaluated condition to increase solubility of  $\alpha$ -mangostin. The lipid phase composed with miglyol and cetyl palmitate under varying concentration at 10, 15 and 20% (w/w). LBNs loaded with  $\alpha$ -mangostin were fabricated using hot homogenization technique, and its physicochemical properties were characterized. Among the development LBNs,  $\alpha$ -mangostin loaded NLC showed the small particle size about 120-150 nm compared to SLN and NE as presented about 140-170 nm and 130-160 nm, respectively. Spherical particle morphology with smooth surface was observed under scanning electron microscope (SEM) and with negative surface values. Stability of SLN and NLC dispersions were investigated. All dispersions of NLC formulation were physically stable for 8 weeks in accelerated condition. Analysis of the effects of ratio liquid and solid lipid on the drug loading was performed by High performance liquid chromatography (HPLC). The results showed that lipid content affected on encapsulation efficiency was higher than 90% for both 10 and 20% lipid content NLC. *In vitro* release studies demonstrated that  $\alpha$ -mangostin-loaded NLC presented an initial fast release then followed by a prolonged release until 72 h., which was dependent on the lipid content. These results supported that LBNs based on NLC could increase the solubility of  $\alpha$ -mangostin, which is our priority to promote the absorption of  $\alpha$ -mangostin for the gastrointestinal tract (GI) delivery.

**Keywords** Lipid based nanocarriers; Nanostructure lipid carrier; Alpha-mangostin

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## Coagulation and Fungal Inhibition of Air Dried Sheet Rubber by using Pyroligneous Acid from Mangosteen Shell process

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The purpose of this study was to investigate the effect of coagulating and anti-fungal activities of pyroligneous acid from a by-product of mangosteen shell charcoal burning. The comparison properties of pyroligneous acid with the commercial wood vinegar, formic and acetic acids, have been measured. - The coagulating efficiency of pyroligneous acid exhibited the shortest possible coagulation time at 10.23 mins between acids and latex. Then, the antifungal efficiency was determined from a fungi growth area at 1.97% on air dried sheet rubber surfaces. Herein the content of acetic and propanoic acids and 2-methoxyphenol, 2-methoxy-4-methylphenol, phenol, 4-ethyl-2-methylphenol, 4-methylphenol, and 2,6-dimethoxyphenol as phenolic compounds with 72.21% and 14.98% respectively of the pyroligneous acids contents were determined by gas chromatography method. The results were found that the coagulating and anti-fungal properties showed in the following order of commercial wood vinegar > mangosteen shell pyroligneous acid > formic acid > acetic acid according to their acidic and phenolic compound contents.

**Keywords** Pyroligneous acid; Wood vinegar; Air dried sheet rubber

## Value-added of Crude Glycerol by Glycerolysis Catalyzed by *Carica papaya* Latex Lipase

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According to the crisis of diesel fuel price, biodiesel is expected to be an alternative fuel. In the production of biodiesel, large amounts of crude glycerol are generated. In this work, crude glycerol was utilized for production of more valuable products, such as monoglycerides. Monoglycerides was produced by glycerolysis reaction of crude glycerol with coconut oils catalyzed by *Carica papaya* latex lipase which have many advantages over the chemical process such as mild reaction condition, high catalytic efficiency and positional specificities. *Carica papaya* latex lipase was separated from latex by centrifugation. Dried lipase particulate showed specific activity at  $812.18 \pm 3.5$  units/mg protein. The average water content and water activity were  $3.62 \pm 0.17\%$  and  $0.395 \pm 0.02$ , respectively. Optimal conditions for coconut oil hydrolysis were  $45 \pm 2.2$  °C and pH  $7 \pm 0.35$  and showed average protein content about  $9.85 \pm 0.15\%$ . Coconut oil obtained from cold pressed extraction method presented composed of high lauric acid (49.2%). Saponification value and iodine value of extracted coconut oil were  $256 \pm 12$  mg KOH/g oil and  $8.4 \pm 0.42$ , respectively. Crude glycerol collected from the biodiesel production through transesterification of used-oil. The partially purified crude glycerol obtained a light brown color at pH  $7.11 \pm 0.35$  and showed  $64.58 \pm 3.22\%$  glycerol content. Monoglycerides were separated from other reaction products by column chromatography. Highest yields of monoglyceride (46.77%) were obtained from reaction that consisted of crude glycerol and coconut oil at molar ratio of 8:1 in 95% ethanol (14% w/w), amount of lipase used ( $a_w = 0.395$ ) was 20 wt% of oil, temperature was controlled at 45°C for 36 hours. The compositions of synthesized monoglyceride were investigated by GC-MS and exhibited high yield of glycerol monolaurate (46.73%). For the biological properties, it was found that glycerol monolaurate did not inhibit *Bacillus* sp. growth.

**Keywords** Crude glycerol; Glycerolysis; *Carica papaya* latex lipase (3-5 words)

## The Effect of TMA/MAO Ratio for Homogeneous Ethylene Polymerization using Metallocene Catalyst

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In general, metallocene catalysts have more important role in ethylene polymerization because of narrow molecular weight distribution, high stereoselectivity, and specific polymer properties control. Methylaluminoxane (MAO) is the most commonly used as co-catalyst to activate metallocene in ethylene polymerization leading to high catalytic performance. However, it always contains trimethylaluminum (TMA) that influences the catalytic activity of metallocene complexes and molecular weight of polymer. In this work, the effect of different TMA/MAO ratios on ethylene polymerization using metallocene catalyst under homogeneous condition was investigated. The TMA/MAO ratio can be measured by nuclear magnetic resonance (NMR) using curve fitting. The polymerization activity upon different TMA/MAO ratios was monitored under the specified polymerization condition. Molecular weight and molecular weight distribution of polymers were determined using gel permeation chromatography (GPC).

**Keywords** Methylaluminoxane; Trimethylaluminum; Metallocene catalyst; Ethylene polymerization

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# A Comparative Study of Different SiO<sub>2</sub>/MAO Ratios on Ethylene Polymerization using A Supported Metallocene Catalyst

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Metallocene is the single site catalyst used to produce polyethylene. It needs to be activated to active form by activator. Methyaluminoxane (MAO) has been used as activator for metallocene in ethylene polymerization because of high efficiency in activating. Polyethylene produced by ethylene polymerization from metallocene activated by methyaluminoxane solution shows high productivity narrow molecular weight distribution. However, fiber likes structure which cause fouling in reactor and pipe in transport is also formed. This problem can be solved by using a supported metallocene. There are many kinds of support for metallocene catalyst, which were studied such as zirconia, clay, silica, magnesia, and etc. Silica has been widely used to be a support for catalysts because of good morphology, thermal stability, high surface area and low cost. Silica has many types and properties such as particle size, surface area, and etc. Therefore, this research is aimed to investigate the effect of SiO<sub>2</sub>/MAO ratios on ethylene polymerization. The different SiO<sub>2</sub>/MAO ratios were employed over supported metallocene catalyst. To determine morphology and functional group on supports, the samples was characterize by means of SEM, N<sub>2</sub> physisorption and FTIR techniques. Ethylene polymerization of each catalyst was tested in 2 L batch reactor.

**Keywords** Supported metallocene; Silica; Methyaluminoxane

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## Effects of Additives in Ethylene Glycol-based Lubricant on Slider Surface

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Nowadays hard disk drive (HDD) is widely used for data storage for both computers and other devices. Read and write head (called slider) is an important component in hard disk drive, which is used for reading and writing data on magnetic media. To perform reading and writing process, the slider will fly over the media at the height less than 12 nm. To maintain this fly height, the precise lapping process is needed to control surface properties of the slider. The important properties are smearing and pole tip recession. To control the surface properties of the slider is challenging because it consists of varieties of materials such as Al<sub>2</sub>O<sub>3</sub>-TiC (AlTiC) for slider body, nickel-iron (NiFe) for magnetic shield, and cobalt-iron (CoFe) for the writer. In this research, nickel iron alloy is used as sample to study pole tip recession. Ethylene glycol based lubricant is used in this process to achieve designed properties. Additives which are used in this process are additive A which is an ionic oxidizing substance that can act as a passivator and additive B which is a large organic substance with carboxylate groups. These additives are added in the lubricant by varying weight percent of additive A from 0 to 1 percent by weight and additive B from 0 to 0.5 percent by weight. The properties of lubricant, i.e., pH, conductivity and viscosity are measured. The effects of additives are measured on the pole tip recession, surface scratch and lap time by quasi-static test and atomic force microscope. The results show that additive A reduces lap time and smearing while both additive A and additive B control the pole tip recession.

**Keywords** Lubricant; Ethylene glycol; Additive; Slider; Lapping process

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## Effect of Lateritic Soil addition on Physical Properties for High Temperature Glaze

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The objective of the study was to investigate the optimization of the appearance of lateritic soil in high temperature glaze for stoneware production. The characterization of lateritic soil was analyzed by particle size analyzer, X-ray fluorescence (XRF) and X-ray diffraction (XRD). The lateritic soil was used in ground forms (ground for 4 hours) as an additive in seger formula. The experiment started with the seger formula containing basic groups of 0.2 mole Feldspar ( $\text{KNaO} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$ ), 0.4 mole Calcium carbonate ( $\text{CaCO}_3$ ), and 0.4 mole Magnesium carbonate ( $\text{MgCO}_3$ ), media group of 0.22 – 0.25 mole Aluminum oxide ( $\text{Al}_2\text{O}_3$ ), 0.025 – 0.10 mole Lateritic soil ( $\text{Fe}_2\text{O}_3$ ) and acid group of 2.0 – 4.0 mole Silicon dioxide ( $\text{SiO}_2$ ) in the optimum ratio and then glazed it by dripping. The specimen was fired at 1200°C in a oxidation atmosphere. The specimens obtained were tested using color meter, optical microscopy (OM), scanning electron microscopy (SEM). The results showed that the component ratio of 41% Feldspar, 15% Calcium carbonate, 13% Magnesium carbonate, 6% Lateritic soil, 14% Lampang kaolinite and 11% Quartz yielded optimum properties of high temperature glaze for stoneware production.

**Keyword** Lateritic soil; Glaze; Stoneware; Physical properties

## **Influence of Particle Size of Grog on Physical–Mechanical Properties of Earthenware Production in Monkaokaew Village, Lampang Province.**

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This research was aimed to study the influence of particle size of grog on physical – mechanical properties of Earthenware Production in Monkaokaew Village, Lampang Province. The grog was used in ground forms with various sizes of 60 $\mu$ m, 100  $\mu$ m, 140  $\mu$ m and 180  $\mu$ m. The characterizations of raw materials were analyzed by the particle size, chemical composition and mineral composition. The mixing ratio of clay body was controlled at 70% red clay and 30% grog. After that, the specimens were fired at 950°C in oxidation atmosphere. Finally, the physical and mechanical properties consisting of the shrinkage, water absorption and bending strength were investigated. The results showed that physical and mechanical properties of clay body with **the** grog size of 180  $\mu$ m were optimum properties. The clay body showed a shrinkage of 9.56%, water absorption of 14.55% and bending strength of 173.52 kg / cm<sup>2</sup>. Therefore the grog achieved the requirements of Thai Community Product Standard (TCPS 46-2549) as well as it reduced 30% cost of raw materials used in the Earthenware Production.

**Keywords** Particle size; Grog; Red clay; Shrinkage

## Synthesis of Three-Dimensionally Ordered Macroporous (3DOM) SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub> supports by Sol-Gel Method

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A three-dimensionally ordered macroporous SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub> (3DOM SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub>) was prepared as a support for CaO, a heterogeneous catalyst for transesterification. TEOS and Al(NO<sub>3</sub>)<sub>3</sub>·9H<sub>2</sub>O were used for 3DOM SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub> synthesis with Si/Al ratio of 1:0.2, 1:0.4 and 1:1. The materials were calcined at 700 °C and 800 °C for 2 hours. Preliminary studies using FTIR and SEM were carried out. It is found that topography of all materials exhibit well-ordered porous structure when comparing with 3DOM SiO<sub>2</sub> support after calcination at 800 °C. The catalytic efficiency for transesterification is still under investigation.

**Keywords** Three-dimensionally ordered macroporous (3DOM); Sol-gel; SiO<sub>2</sub>; Al<sub>2</sub>O<sub>3</sub>; CaO

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## Improvement on Properties and Reactivity of Hybrid Catalytic Adsorbents for Sorption-Enhanced Hydrogen Production

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Hydrogen is considered to be an ideal energy carrier and plays an important role in clean energy system due to its high energy density and environmental friendliness. Sorption-enhanced steam methane reforming (SESMR) process, a process that combined with in situ CO<sub>2</sub> capture, has been developed to implement the requirement of hydrogen demand. One of the key developments of this process is the improvement of catalyst/sorbent material to shift the equilibrium toward H<sub>2</sub> production. By introducing an adsorbent into the reaction system for selective separation of carbon dioxide, high hydrogen purity can be obtained in a single step as steam reforming, water-gas shift, and carbon dioxide removal reactions can occur simultaneously. This work presents an investigation of the synthetic one-body hybrid catalytic/sorbent material to serve for the production of hydrogen in the process intensification SESMR. Catalytic NiO incorporated with calcium-based alumina sorbents prepared from different calcium precursors and with the use of additives are subjects of the investigation. Characterization results of the materials by XRD, SEM, and N<sub>2</sub> adsorption/desorption isotherms show that an addition of surfactant cetyltrimethyl ammonium bromide (CTAB) can improve the properties of the sorbent materials toward CO<sub>2</sub> adsorption by increasing active surface area with uniform smaller particle size compared to the commercial material. It was observed that the adsorption of CO<sub>2</sub> is improved approximately 33% higher than the commercial one and the sorbent can be used for multiple cycles with good cyclic stability. The surface of CaO-based alumina sorbent was successfully modified by incorporation with NiO to serve as one-body hybrid catalytic/sorbent and was applied for the sorption-enhanced steam methane reforming process. Hydrogen production experiments were carried out in a packed-bed reactor at temperature of 600°C and atmospheric pressure. The results show that 80% conversion of CH<sub>4</sub> was obtained with 70% of hydrogen production.

**Keywords** CaO-based sorbent; CO<sub>2</sub> capture; Hydrogen production; Sorption-enhanced steam methane reforming

## Chemoselective Hydrogenation of Acrolein over Pt Supported Catalyst

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Allyl alcohol can be produced by chemoselective hydrogenation of acrolein at atmospheric hydrogen pressure. Dehydration of glycerol to the feed acrolein was carried out at 300 °C over acid zeolite HZSM-5. The SiO<sub>2</sub> and TiO<sub>2</sub>-supported Pt catalysts were studied for chemoselective hydrogenation of the acrolein at 100 °C. The catalysts were prepared by incipient wetness impregnation method using H<sub>2</sub>PtCl<sub>6</sub>·(H<sub>2</sub>O)<sub>6</sub> as the precursor of Pt. The catalytic reactions were performed on a fixed-bed reactor using hydrogen as a carrier gas. The products were analyzed by on-line gas chromatography. Over Pt/SiO<sub>2</sub>, the high selectivity to the primary products propanal and propanol were mainly obtained. On the contrary, the selectivity to allyl alcohol (~37 %) can be observed over Pt/TiO<sub>2</sub> with 40 % acrolein conversion. The selectivity of allyl alcohol depends largely on the catalyst's pre-reduction temperature (400-500 °C). The selectivity of unsaturated alcohol over Pt/TiO<sub>2</sub> catalysts is determined by the metal particle size and the extent of decoration of TiO<sub>x</sub> on Pt particles after reduction at 500 °C. The presence of coordinatively unsaturated Ti cations in these oxide particles enhances the adsorption of the C=O bond resulting in an improved selectivity to allyl alcohol.

**Keywords** Acrolein; Allyl alcohol; Pt/SiO<sub>2</sub>; Pt/TiO<sub>2</sub>; Chemoselective hydrogenation

## Preparation Method of Carbon Nanotube-based Anodes for Microbial Fuel Cell

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Microbial fuel cell (MFC) is an eco-friendly technology for renewable energy recovery, in which the substrate is biologically treated and electrical energy is generated. Among all MFC parts, electrode materials play a crucial role in electricity generation. Carbon nanotubes (CNTs) are promising candidates as electrode materials due to their physical and chemical properties. In this study, CNT-based anodes were fabricated using simple and cost effective filtration method. Multi-walled carbon nanotubes with carboxyl group (MWCNTs-COOH) were dispersed in Triton X-100 and MWCNTs with hydroxyl group (MWCNTs-OH) were dispersed in Sodium dodecyl sulfate (SDS). The homogenized MWCNT suspension was then vacuum-filtered through a Poreflon membrane filter. After drying at room temperature overnight, the attached MWCNTs on Poreflon membrane were directly used as an anode. The quality of the prepared anodes was measured by using scanning electron microscope (SEM) and MFC operation.

**Keywords** Anode; Carbon nanotube; Microbial fuel cell

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