

THE FUTURE FOR FARMING AND FOOD ENGINEERING

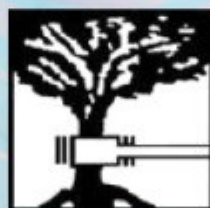
AGRICULTURE

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INTERNATIONAL
CONFERENCE ON
AGRICULTURAL AND
FOOD ENGINEERING

CAFE*i* 2020

JOINT CONFERENCE WITH



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3 - 4 FEBRUARY 2021

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12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION



13 CLIMATE
ACTION



ABSTRACT BOOK

**5th International Conference on
Agricultural and Food Engineering
(CAFE*i*2020)
3rd – 4th February 2021**



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1. CAFEi2020_004_004

Effects of carboxymethyl cellulose extracted from oil palm empty fruit bunch stalk fibers on the properties ice cream

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Abstract

Interest in alternative sources is critical to ensure the sustainable production of CMC. The current extraction of carboxymethyl cellulose (CMC) from wood has created competition with wood industries. Therefore, the extraction of CMC from oil palm empty fruit bunch (OPEFB) stalk fibers was done and prior to the production of the extracted CMC, the potential application of the extracted CMC from OPEFB stalk fibers were analysed on hard ice cream properties. Such data are useful in accessing the overall quality during the production and handling of hard ice cream, as well as in developing a desirable mouthfeel. The extracted CMC from OPEFB stalks fibers was able to increase the viscosity of liquid ice cream mixture (129.4cp) and hard ice cream produced by using the extracted CMC showed good and comparable melting characteristics as it had the almost similar melting rate trends with hard ice cream produced using commercial CMC, with melting resistance (60.28%), lower overrun (35.2%) and lower hardness (28.88N) which will make the hard ice cream creamier, smoother and richer taste.

Keywords: Carboxymethyl cellulose (CMC), oil palm empty fruit bunch (OPEFB), stalks fibers, hard ice cream

2. CAFEi2020_006_006

Shelf life prediction of pineapple during storage at different temperatures

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Abstract

Shelf life estimation is a significant factor in determining the quality and freshness of fruits. This study aimed to investigate the shelf life and the physicochemical properties changes of pineapples stored at a chilling temperature of 7 °C and an ambient temperature of 25 °C during storage. The effect of temperature on the pineapple changes in total soluble solids, pH, moisture content, firmness, and colour were evaluated for three weeks of storage period. An increase in total soluble solids, moisture content, and colour values were observed in both storage temperatures and time. The pH and firmness values decreased until the end of the storage period. The firmness and moisture content showed high regression coefficients, hence were used for the shelf life prediction of pineapple based on the Arrhenius model. The results demonstrated that the shelf life prediction was 27.77 and 16.68 days for samples stored at 7 °C and 25 °C in relation to the firmness. In regard to moisture content, the shelf life prediction of pineapples at 7 °C and 25 °C were 29.26 and 21.19 days, respectively. The finding indicated that shelf life estimation plays an important role to improve the quality preservation of fresh fruits and vegetables during storage.

Keywords: Pineapple, Quality, Shelf life, Storage, Temperature

3. CAFEi2020_007_120

Ultrasound-assisted extraction and gaseous ozone as preservation method for roselle (*Hibiscus sabdariffa* L.) fruit juice

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Abstract

Ultrasound extraction and ozone treatment are promising non-thermal hurdle technologies which can increase the extraction yield while minimizing the loss of nutritional qualities of Roselle fruit juice. Response surface methodology (RSM) was used to investigate the effect of ultrasound time and temperature on juice yield. The optimized points were found at 4.4 min and 22°C, where the extraction yield of the Roselle fruit juice achieved a maximum of 80%, 12% higher than the control sample without ultrasound treatment. Roselle fruit juice (unfiltered and filtered) was then ozone-treated with processing variable of treatment time (0–30 min). Effects of processing variables on physicochemical characteristics of Roselle fruit juice were determined and no significant differences ($p > 0.05$) in pH and titratable acidity (TA) were observed. However, significant effect ($p < 0.05$) was found in total color difference (TCD), ascorbic acid (AA), total phenolic content (TPC), and total anthocyanin content (TAC) with increased ozone treatment time. Nevertheless, degradation of AA was less than 50%, which showed that ozone has the potential to prolong the shelf life of Roselle fruit juice. Thus, the synergistic effects of ultrasound and ozone treatment on Roselle fruit juice should be carefully considered by processors prior to its adoption as a preservation technique.

Keywords: ultrasound, ozone, fruit juice, roselle, physicochemical, antioxidant properties
Particle size, compaction characteristic and tablet strength of spray-dried fermented jackfruit pulp - microcrystalline cellulose binary powder mixture

4. CAFEi2020_011_009

Irrigation and crop water requirement estimation for oil palms using soil moisture balance model in Peninsular Malaysia

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Abstract

This study presents the irrigation and crop water estimation in a Malaysian oil palm plantation for effective irrigation water management during water years 2013 and 2014. The study area was divided into four plots: 2000, 2002, 2006 and 2010, indicating years of peat swamp forest conversion to oil palm plantation. Hydrologic Engineering Centre-Hydrologic Modeling System (HEC-HMS) and Soil moisture balance hydrologic models were used to model the rainfall-runoff in the basin. Statistical analysis using coefficient of determination (R^2) and Nash–Sutcliffe efficiency coefficient (NSE) were used to evaluate the performance and correlation of the two hydrologic models. The result showed that R^2 and NSE were 0.94 and 0.90 respectively for calibration and 0.92 and 0.54 respectively, for monthly validation. This showed that the models performed well for simulation of the peatland hydrology. With the modelling of rainfall-runoff satisfied, the irrigation demand of the study plots was determined using the same soil moisture balance model. The irrigation demand ranged from 0.893 to 1.6 million cubic meters (MCM) in 2010 and 2000 study plots respectively. Irrigation demand is observed to be site specific which depends on the soil moisture deficit, readily available water in the oil palm root zone and oil palm rooting depth. Estimation of a future oil palm water requirement using the soil moisture balance model would be recommended for further studies for use as an advisory manual for the oil palm managers to enhance adequate water resources planning for oil palm productivity.

Keywords: Runoff estimation, Oil palm plantation, Soil moisture balance, Hydrological models, Irrigation water demand

5. CAFEi2020_012_010

Particle size, compaction characteristic and tablet strength of spray-dried fermented jackfruit pulp - microcrystalline cellulose binary powder mixture

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Abstract

The tableting properties for fermented spray dried jackfruit (FJP) and microcrystalline cellulose (MCC) powders were studied. 25% FJP + 75% MCC, 50% FJP + 50% MCC and 75% FJP + 25% MCC binary powder mixtures were compacted into tablet form at various compaction pressures ranging from 15.1 to 73.8 MPa. The properties were compared to pure FJP and MCC tablets. The addition of MCC resulted in a higher particle size and the increased in the plastic work of the tablet. The best ratio of FJP-MCC binary tablet was found to be at 25% FJP + 75% MCC where the tablet showed the highest tensile strength. In conclusion, the addition of MCC to FJP improved the compaction characteristics and the tablet mechanical strength.

Keywords: Compaction, jackfruit, tablet, strength, mcc, microcrystalline cellulose

6. CAFEi2020_014_012

The elastic recovery, ejection work, strength and dissolution of instant coffee tablet containing croscarmellose sodium disintegrant

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Abstract

Croscarmellose sodium disintegrant agent, commonly used in the pharmaceutical tablet formulation was employed in the instant coffee tablet formulation. Various compositions of croscarmellose sodium was added to the instant coffee tablet formulation; 20 %w/w, 40 %w/w, 60 %w/w and 80 %w/w respectively. These mixtures were then compacted through the uniaxial die compaction process forming 1 g tablets having 13 mm diameters each at various compaction pressures of 37.7 MPa, 75.4 MPa, 113.0 MPa and 150.7 MPa. The ejection work done when ejecting the tablet from the die was calculated to represent the frictional resistance to tablet motion during ejection. The tablet elastic recovery was measured as a quantitative measure of the tablet physical dimensional stability. Meanwhile, the mechanical strength as well as the tablet dissolution were also measured. The results showed that the croscarmellose composition and the compaction pressure affected all the studied tableting properties. Generally, croscarmellose sodium increased the tablet elastic recovery and lowered the tablet ejection work, tensile strength and dissolution time in experimental conditions employed in this work. However, the extent of the croscarmellose sodium influence was clearly dependent upon the compaction pressures used for instant coffee tablet formation.

Keywords: instant coffee tablet, compaction, elastic recovery, ejection, dissolution, tablet strength

7. CAFEi2020_016_029

Energy audit of rice production in West Sumatra Indonesia

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Abstract

Audit energy is an appropriate method to determine the energy consumption expended in each agricultural cultivation activity, thereby reducing the wasteful use of energy. Energy consumption in the rice cultivations consists of humans, fuel, machinery, seed, fertilizer and pesticides. The objective of the study is to analyze total energy consumptions and economic in the form of an energy audit activity on lowland rice cultivation in West Sumatera Indonesia. Energy inputs are measured during all operating activities in rice cultivation (seeding, tillage, planting, fertilizing, spraying, weeding, and harvesting). Energy input analysis based on energy sources used is divided into six parameters, namely: engine energy, fuel, humans, seeds, chemicals (pesticides), and fertilizer energy. The result shows the average of the total energy inputs in this study is 16,816,612 MJ/ha distributed to human, fuel, machinery, seeds, fertilizers, and pesticides energy respectively 216.39; 890.75; 60.02; 983.29; 14,207.54; and 458.60 MJ/ha. Production costs incurred in rice cultivation activities in this study were RP 13,107,562/ha. Finally, the rice yield prediction model based on input energy are $Y_1 = 4786,560 - 28,286X_1 + 36,226X_2 - 24,727X_3 - 8,426X_4 + 0,057X_5 - 0,803X_6$ and $Y_2 = 3605,110 + 5,443X_2$. Data of the total energy are needed as a recommendation for government to balance energy input and output on rice cultivations.

Keywords: Audit Energy; Economics; Energy Input Analysis; Rice Cultivations

8. CAFEi2020_020_125

Characterization of active sweet potato-based films containing thymol at different varieties: VitAto™ and Anggun

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Abstract

Sweet potato starch (SPS) films from local Malaysia varieties particularly, VitAto (orange-fleshed) and *Anggun* (purple-fleshed) were developed to characterize the physical, mechanical, thermal, and antimicrobial properties. The SPS films were fabricated by casting technique, incorporating different types and contents of plasticizer (0, 15, and 30%). The VitAto SPS films exhibited higher brightness and lower solubility in water than the *Anggun* SPS films. Regardless of the types of plasticizer, the VitAto SPS films at 15% loading of plasticizer demonstrated better mechanical and thermal properties than the *Anggun* SPS films. The glycerol-plasticized SPS films showed lower tensile strength (TS) and higher elongation at break (EaB) at 15% loading of plasticizer than the sorbitol-plasticized SPS films. The SPS films containing 5% thymol increased the film solubility in water and the EaB, while reduced the TS remarkably. The SPS films with thymol were able to inhibit the growth of *S. aureus* and *E. coli* via liquid media as well as the growth of fungal on cherry tomato samples.

Keywords: films; sweet potatoes starch; orange-fleshed; purple-fleshed; solvent casting; tensile properties; thymol; antimicrobial activity.

9. CAFEi2020_023_172

Membrane-based clarification of banana juice: Pre-treatment effect on the flux behavior, fouling mechanism and juice quality attributes

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Abstract

The processing of banana into clarified juice provides an alternative in the beverages market, but further exploration of the related processing is required. Hence, this study investigated the pre-treatment effect during the membrane-based process on the flux behavior, fouling mechanism and banana juice quality attributes. Observation on juice viscosity was done after the crude banana juice was pre-treated with 0.1 – 0.5 % pectinase. Both pectinase-treated and untreated banana juices were then subjected to an ultrafiltration process using a 100 kDa dead-end polyethersulfone membrane to clarify the juice. This study found a 50-55% viscosity reduction of the banana juice after the pre-treatment, with no significant difference in terms of the pectinase concentrations. Pre-treatment of the banana juice prior to ultrafiltration also have improved the permeate flux by 65.5% compared to the untreated sample. Based on the fitting of several fouling models, cake layer formation on the entire surface of the membrane was identified as the main cause of the membrane fouling and flux deterioration. The ultrafiltration process has significantly improved the juice turbidity, total soluble solid and color, at a stable pH, indicating the success of the clarification process.

Keywords: Banana, clarification, fruit juice, membrane process, pectinase, ultrafiltration

10. CAFEi2020_024_026

Using a semi-conjugate model to evaluate the potential of drying multiple food in a hybrid infrared and convective dryer

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Abstract

Combined hot-air and infrared drying (CHAID) is a novel thermal drying method that is promising and have the potential to produce dehydrated food of high quality. This method dries food faster, consumes less energy and reduces the emission of greenhouse gas to the environment. However, for a pilot or industrial scale CHAID to be developed, more understanding on its scalability is required. Upscaling of CHAID method requires insight into what goes on in the drying environment and within the product. In this study, a semi coupled conjugate model was developed for food during CHAID. The developed model was simulated using COMSOL multiphysics software. The moisture and temperature evolutions from the simulations were validated using data obtained from sweet potato drying experiments. The relative contribution of fan and infrared emitter in both the sample and surrounding domains was highlighted. The results showed that the developed conjugate model performed better than the existing CHAID models.

Keywords: Upscaling, Hybrid dryer, Novel-thermal drying, Food

11. CAFEi2020_025_051

Effects of different storage temperatures on the quality and shelf life of Malaysian sweet potato (*Ipomoea batatas* L.) varieties

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Abstract

In this study, we investigated the effects of different storage temperatures on the quality and shelf-life of Malaysian sweet potatoes in terms of moisture content (MC), soluble solids content (SSC), colour values (L^* , a^* , b^*) and textural properties. Samples from the three locally-produced sweet potato varieties in Malaysia namely: *Keledek Anggun 3* (V1), *Keledek Jingga* (V2), and *Keledek Kuning* (V3) were purchased and stored at 5 °C, 15 °C and 30 °C for a period of 21 d with a relative humidity (RH) range of 80-90 %, 70-80 % and 50-60 %, respectively. A multiple correlation analysis was employed in establishing the relationships between the changes in all the quality parameters (QP). The results showed that the QP of sweet potatoes in all varieties were significantly affected ($P < 0.05$) by the different storage temperatures applied. The results likewise revealed that the changes in the QP of sweet potatoes during storage vary according to varieties. Moreover, the scanning electron microscopy (SEM) analysis showed obvious variations in the microstructural properties of the samples associated with the storage treatments used. Among all the measured QP, the textural properties recorded a high relationship ($r > 0.60$; $*P < 0.05$) with the other QP particularly with the flesh colour values L^* , a^* , and b^* of V3 under 5 °C and 15 °C storage conditions. The principal component analysis (PCA) supported the study in discriminating the observed variances of the QP with over 90 % explained accuracies. Hence, the study found that the different storage temperatures have a significant effect on the quality and shelf-life of sweet potatoes of different varieties.

Keywords: Quality; Shelf-life; Storage; Sweet Potato; Temperature; Variety

12. CAFEi2020_026_023

Kinetic modelling for respiration rate of papayas (*Carica papaya* L.) coated with *Kelulut* honey nanoparticles during cold storage

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Abstract

This study assessed the respiration rate of uncoated and coated papayas (*Carica papaya* L.) with 15% of *Kelulut* honey (KH) nanoparticles (Nps) coating solution during cold storage at 12 ± 1 °C for 21 days. The respiration rate of the papayas significantly changed during storage with increment in CO₂, as well as reduction in O₂ and C₂H₄. The changes in respiration rate were rather slower for coated papayas, when compared to uncoated ones. A kinetic model was established from the experimental data to describe the changes of O₂, CO₂, and C₂H₄ production in papayas throughout the storage period. All O₂, CO₂, and C₂H₄ were experimentally retrieved from a closed system method and then represented by the Peleg's model. The outcomes indicated the Peleg's constant K_1 and K_2 , which were gained from linear regression analysis and coefficients of determination (R^2), seemed to fit well with the experimental data, whereby the R^2 values exceeded 0.85 for both coated and uncoated papayas. The model confirmed both the capability and predictability aspects of the respiration rate displayed by papayas coated with KH Nps throughout the cold storage period.

Keywords: Kinetic model; Peleg constant; Papaya; Respiration rate; Nanoparticles coating; Shelf life

13. CAFEi2020_028_019

Challenges of green cleaner and sanitiser: Storage and cost of electrolyzed water

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Abstract

Green cleaner and disinfectant can provide better environment and they can induce cleaning cost savings by eliminating the cost of harsh cleaning chemicals, saving cleaning chemicals storage space, reducing cost for wastewater treatment and reducing logistics cost for the chemical supply. This study explores the personal view of SMEs production managers towards the challenges during cleaning and disinfection process and their readiness in accepting green cleaner and disinfectant. In this work, the advantages and disadvantages of electrolyzed water (EW) as green cleaner were explored. A lab-scale batch ion-exchange membrane electrolysis unit was used to produce acidic electrolyzed water (AcEW) and alkaline electrolyzed water (AIEW). The stability of AcEW and AIEW were also studied based on its physical changes (pH, oxidative-reduction potential (ORP), chlorine content and hydrogen peroxide content) in 7 days of storage, which measurements were taken daily. The pH maintained for both AcEW and AIEW during the 7 days of storage. The ORP maintains at plateau for the first 5 days of AcEW storage. After 5 days, two of experiments show decrease profile while for repetition 2 remains at plateau. While ORP for AIEW increase drastically between day 1 and 2. Then ORP reaches plateau after day 3. The free chlorine, total chlorine and hydrogen peroxide content were 10 mg/L on the day of production. However all the properties decreased gradually and there were no chlorine and hydrogen peroxide were detected on the 7th day. Result from this study can be used as a guideline to store and to understand the stability of the EW, which can benefit the SMEs food manufacturers.

Keywords: Disinfection, Electro-chemically activated water, Electrolysis, Food safety, Novel disinfectants, Sanitation, Sustainable cleaning.

14. CAFEi2020_032_021

Prediction of quality attributes and maturity classification of pear fruit using laser imaging and artificial neural network

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Abstract

In this study the application of laser imaging technique was utilized to predict the quality attributes (firmness and soluble solids content) of Pear fruit and to classify the maturity stages of the fruit harvested at different days after full bloom (dafb). Laser imaging system emitting at visible and near infra-red region (532, 660, 785, 830 and 1060 nm) was deployed to capture the images of the fruit. Optical properties (absorption μ_a and reduced scattering μ_s' coefficients) at individual and combined wavelengths of the laser images of the fruit were used in the prediction and classifications of the maturity stages. Artificial neural network (ANN) was employed in the building of both prediction and classification models. Root mean square error of calibration (RMSEC), root mean square error of cross-validation (RMSECV), correlation coefficient (r) and bias were used to test the performance of the prediction models while sensitivity and specificity were used to evaluate the classification models. The results show that there is a very strong correlation between the μ_a and μ_s' with pear development. This study has shown that optical properties of pears with ANN as prediction and classification models can be employed to both predict quality parameters of pear and classify pear into different (daft) non-destructively.

Keywords: Laser imaging, Maturity stages, Quality attributes, Pear, Optical properties

15. CAFEi2020_036_025

Relationship of oil palm crown features extracted using Terrestrial Laser Scanning for Basal Stem Rot disease classification

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Abstract

The oil palm is the largest plantation industry in Malaysia. It has been one of the major contributors to the country's economy and the main pillar of the commodity sectors. For over 40 years, the oil palm industry has faced a lethal and incurable disease, Basal Stem Rot (BSR), which is caused by a type of bracket fungus, *Ganoderma boninense*. The oil palm physical symptoms infected by BSR disease are appearance of many unopened spears, flattening of crown and smaller crown size. Terrestrial Laser Scanning (TLS, also known as ground-based LiDAR) can be used to provide accurate and precise information on tree morphology with high resolution. This study proposed an image processing technique using the ground input data taken from a TLS. Five parameters were used in the study are number of laser hits in strata 200 cm and 850 cm from the top, namely as C200 and C850, respectively, crown area, frond number and frond angle. The objectives of this study are to analyse the relationship between the parameters and to study the relationship of the parameters with the levels of BSR disease. Results have shown that all parameters were significant in all levels of healthiness with p-values less than 5%. Frond number and frond angle showed the highest correlation value, which is equal to -0.94. Frond angle is increasing, while frond number and crown area are decreasing concurrently with the severity levels of BSR infection.

Keywords: LiDAR, Point cloud, Image processing, Crown strata, Oil palm, BSR.

16. CAFEi2020_038_028

Assessment of the readiness of extension workers in Benue State Agricultural and Rural Development Authority (BNARDA) to deliver effective extension services in Benue State, Nigeria in the 21st century

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Abstract

The study assessed the readiness of extension workers at Benue State Agricultural and Rural Development Authority (BNARDA) to deliver effective extension services in Benue State, Nigeria in the 21st century. The study covered all the four categories of extension workers in the three agro-ecological zones of the State. Multi-stage random sampling technique was used to select the sample size and data were collected using questionnaire. The study showed that agricultural extension workers were highly inadequate and had low knowledge and skills in Information and Communication Technology (ICT) applications. The use of internet services for the purpose of searching and disseminating agricultural information was quite low especially among the Block Extension Supervisors and Village Extension Agents. The leading constraints to ICT use by extension workers in BNARDA were high cost of ICT devices/services, poor infrastructural facilities like electricity supply and inadequate training. Governments and donor agencies should prioritize the provision of computers, internet services and trainings for extension workers in BNARDA.

Keywords: Assessment, Extension, Readiness

17. CAFEi2020_039_078

Artificial intelligence techniques in solar cells and solar energy applications.

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Abstract

Artificial Intelligence (AI) and Machine Learning (ML) models play an important role in predicting, modelling and analysing the performance of renewable resources. This energy is free, clean, and its effective harnessing and use are of great importance to the world at the time of high fossil fuel costs. But the available renewable energy resources are not being utilized to its fullest. Artificial Intelligence has come to play, in enhancing the efficient usage of renewable resources. The use of the AI techniques in the environmental and renewable energy applications has increased with recognition of its potential. ML models are identified and are further classified according to the ML modelling technique, energy type, and the area of its application. One resource, which could be efficiently and economically used, is sunlight, due to its abundance. AI techniques have become popular for efficiently using sunlight to produce electricity. This stored electricity can be used in rural, under-developed areas and comfortably in the field of agriculture too. The major objective of this paper is to illustrate how artificial intelligence plays an important role in modelling and prediction of the solar system. The paper outlines an understanding of how Artificial Neural Networks (ANNs) and Expert Systems produce patterns after being trained for predictions and classification. The paper further concludes that, using hybrid models, there is a sharp increase in the precision and accuracy of the ML models in energy systems.

Keywords: Algorithms, Artificial Intelligence, Artificial Neural Networks, Expert Systems, Machine Learning

18. CAFEi2020_045_042

Phytochemical content, antioxidant activity and mineral elements of honey produced by four different species of Malaysian stingless bees

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Abstract

This study investigated the phytochemical composition of honey from four species of Malaysian stingless bee, which consists of total phenolic content (TPC), total flavonoid content (TFC), antioxidant activity, pH, color intensity, and mineral element analysis i.e. Magnesium (Mg), Calcium (Ca), Zinc (Zn), Potassium (K), and Sodium (Na). The honey was collected from four different species in Malaysia i.e. *Tetragonula laeviceps*, *Geniotrigona thoracica*, *Lepidotrigona terminata*, and *Heterotrigona itama*. The production of honey by the *L. terminata* species has the highest TPC value (6.74 ± 0.57 mg GAE/100g FW). Meanwhile, the honey produced by *T. laeviceps* species possesses the highest TFC value (14.85 ± 3.71 mg QE/100g FW). In the antioxidant activity measurement, honey from the *H. itama* species obtained the highest percentage of 1,1-diphenyl-2-picrylhydrazyl (DPPH) inhibition (29.52 ± 0.45 %) and honey from *T. laeviceps* species resulted in the highest value in the Ferric reducing antioxidant power (FRAP) analysis (0.95 ± 0.013 abs). The color intensity of honeys produced by four distinct stingless bee species demonstrated the variation of color intensity in the range of 0.09-0.23 abs mAU. Furthermore, all honey obtained the pH values (4.75-5.03) within the acidic medium. Mg is the major mineral element in all honey samples followed by Na, Ca, K, and Zn.

Keywords: Malaysian stingless bee honey; total phenolic content; total flavonoid content; antioxidant; mineral elements

19. CAFEi2020_050_044

The difficulties in achieving homogeneity when mixing a cohesive and a flowable powder materials using a common laboratory powder mixer

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Abstract

This study presents the homogeneity obtained when mixing a cohesive and a flowable powder materials using a laboratory powder mixer. The mixing process parameters studied were the mixing time and the mixer rotational speed at the different ratios of the cohesive cocoa and flowable mannitol powder materials. The homogeneity were sampled at the powder bed surface showed that only at the highest rotational speed of 60 rpm used in this work yield acceptable homogeneity at the two extremes of the powder mass ratios; 95%:5% and 5%:95% of mannitol:cocoa for some of the locations on the powder bed surface, especially near the wall of the mixer. Other combinations of the experimental conditions did not yield acceptable mixture homogeneity. These results highlight the common mixing problems faced when mixing cohesive powder materials especially in academic teaching and research laboratories using a simple powder mixer apparatus.

Keywords: cohesive, mixing, powder rotator, flowability, tumbling bed, homogeneity

20. CAFEi2020_052_062

Application of organic photovoltaic materials (OPV) as greenhouse roof structures: A review

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Abstract

Organic Photovoltaic (OPV), as a third-generation PV technology, is becoming an appropriate substance used for greenhouse roofing structures. Semi-transparent OPV has a variety of merits such as low weight, flexibility, low environment impact and short energy payback time. Besides, it can harness larger amounts of sunlight as means of a very strong light absorbent material. This study shares some of the latest research which examines the feasibility of using semi-transparent, flexible organic photovoltaic (OPV) modules as greenhouse shading material. By using such modules, it may be possible to utilize the existing greenhouse-based agricultural areas for electricity production. The concept projects OPV modules to shade greenhouses and reduces excess solar energy which may result in reducing internal surrounding heat thus helps to mitigate the control environment. This will furthermore control plant heat stress which is one of the most important factors for plant growth. Some conclusion on the quality and quantity of plants with respect to the energy consumption in the greenhouse are also discussed.

Keywords: Organic PV, Plant Heat stress, Shading elements, Greenhouse, Tropics

21. CAFEi2020_057_050

Finite element analysis for fruit puncture resistance

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Abstract

In this study, the finite element method (FEM) was utilized to predict the rupture susceptibility of papayas. The FE model provides a physics-based understanding of the effect of the puncture force and fruit tissues interaction. The fruit properties at different storage days were measured using the puncture-compression test. From the experimental data, the properties of initial firmness, average firmness, apparent modulus of elasticity, rupture force, toughness, and deformation at the rupture point were found to be sensitive to maturity stages. The fruit was then modelled as a multiscale body of flesh and skin to establish the elastic-plastic FE model. The study considers two main components of puncture mechanics which are the interactions at the crack tip and the penetration of the needle-like probe into the skin-flesh fruit tissue. Results of FEM-based simulation showed that the rupture susceptibility increased with ripening days, indicating that the rupture force could be used as a firmness representative parameter, as has been used by many researchers.

Keywords: Finite element method; Papayas; Puncture force; Rupture

22. CAFEi2020_059_053

Optimization of palm oil extraction from decanter cake by Soxhlet extraction using response surface methodology

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Abstract

Response Surface Methodology (RSM) was applied to study the optimum condition of palm oil extraction from oil palm decanter cake (OPDC) using Soxhlet extraction and n-hexane as solvent. The main objective of this study was to achieve maximum oil extraction by determining the optimum of two parameters such as reaction time and solid to solvent ratio. The optimum parameters were found to be at 4.92 hours of reaction time and solid to solvent ratio of 1:10. The proposed model shows R^2 value of 0.78 where the experimental parameters were significant to the result. The optimized data was employed for comparison of oil yield for OPDC without and with microwave pre-treatment. OPDC with microwave pre-treatment yielded 3.289 ± 0.047 g of palm oil which was higher than OPDC without microwave pre-treatment which yielded only 3.107 ± 0.085 g of palm oil. Fourier Transform Infrared Spectroscopy (FTIR) analysis also revealed the abundance of C-H alkene stretch and C=O stretch, two major functional groups indicated the present of fatty acid within the palm oil derived from both samples. Scanning electron microscopy (SEM) of decanter cake provided evidence that the OPDC with pre-treatment has more shrinkage on the surface after Soxhlet extraction compared to OPDC without pre-treatment. Results of this study revealed that RSM helps to optimize parameters in agricultural processing.

Keywords: Soxhlet, palm oil, microwave, pre-treatment, extraction.

23. CAFEi2020_061_057

Food waste solution at home: Conventional and rapid composting techniques

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Abstract

The food waste is a significant concern in waste management in recent years due to the inevitable outcome of human consumption in modern society, and it has happened in almost every home daily. In Malaysia, 44.5% of organic waste (OW) consists of food waste (FW), this figure would increase with population growth. Therefore, without effective FW management will cause environmental pollution, thus affecting human health as well as ecosystem. Conventional method such as landfill and incineration have long been the most popular practice to address the FW issues, offering as simple and cost-effective approach. Most of the time, these methods are not sustainable since they pose other environmental pollution such as greenhouse gas (GHG) emissions and leachate contamination leading to groundwater pollution. Other issues with landfills are that self-composting at landfill site takes a long time to decompose, and most landfills in Malaysia are almost at full capacity. The composting technique has recently gained more attraction as a cost-effective and sustainable method for the FW issue. This paper is presented to objectively review techniques of composting of food waste at home by using conventional natural and rapid process. This review also attempts to extensively discuss the performance of each technique in terms of cost, sustainability, user-friendly and time. Finally, this paper briefly discuss the future direction of food waste solution by sustainable composting technique.

Keywords: Food waste management, decomposition technique, conventional and rapid composting

24. CAFEi2020_062_058

Adding mannitol to cocoa tablets: Compaction behaviour, tablet strength and disintegration characteristics

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Abstract

Cocoa powder is an important ingredient in the confectionary industry and mannitol is an alternative sugar alcohol. In this work, mannitol powder was mixed with cocoa powder and compacted into tablet forms via the uniaxial die compaction process. The composition of mannitol in the mannitol-cocoa tablet was varied at of 95% w/w, 50% w/w and 5% w/w, while pure 100% w/w mannitol and cocoa tablets were set as controls. The compaction pressures used in making the tablets were varied at 37.67 MPa, 75.34 MPa, 113.01 MPa, 150.68 MPa and 188.35 MPa. The compaction behaviour of the powder during the compaction process was evaluated using the plastic work and the maximum ejection stress values. The tablet strength was determined using the tensile strength method and tablet disintegration study was also conducted. The results showed that the increase in the compaction pressures increased the plastic work, maximum ejection pressure, tablet strength and also its disintegration time. Meanwhile, the influence of mannitol composition in the tablet on these observed responses were dependent upon the compaction pressures used during tablet formation. In conclusion, the addition of mannitol improved the tablet strength and shorten the disintegration time in the experimental range employed in this study.

Keywords: cocoa, mannitol, compaction, food tablets, tablet strength, tablet disintegration

25. CAFEi2020_068_098

Fermented jackfruit leaf– a promising product for the management of diabetes mellitus

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Abstract

Diabetes mellitus is complicated multifactorial disorders characterised by hyperglycemia or glucose intolerance. Globally, the number of people suffering of diabetes has increased steadily. Jackfruit leaf, a rich source of phytochemicals offer opportunity for the development of value-added product. A fermented jackfruit leaf product was developed using symbiotic culture of bacteria and yeast (SCOBY) as cost effective beneficial treatment for the mankind in the management of diabetes. The effectiveness of this fermented jackfruit as anti-diabetic therapy agent was evaluated using Streptozotocin-induced Sprague Dawley rats model for a duration of 4 weeks. The findings depicts that, there was a remarkable reduction of blood glucose level in fermented jackfruit leaf-treated diabetic rats as opposed to non-treated diabetic rats, comparable with metformin-treated diabetic rats. The body weight and relative various organ weights of diabetic rats treated with fermented jackfruit leaf showed a healthy recovery sign from diabetes symptoms. The blood haematology profile, liver and kidney function analysis revealed no toxic effect of prolong consuming fermented jackfruit leaf. These results indicated that fermented jackfruit leaf has similar anti-diabetic properties with commercial anti-diabetic drug with no adverse side effect. Promisingly, it offers cheaper source to alleviate the diabetes epidemic in a natural way.

Keywords: Fermentation, jackfruit leaf, anti-diabetic effect, Streptozotocin-induced, haematology profile

26. CAFEi2020_072-067

Molecular diversity and compositional analysis of microbiota in aged refuse biofilter revealed by amplicon sequencing

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Abstract

The increasing significance of aged refuse biofilters for biodegradation processes in wastewater treatment necessitated the constant search for its bacterial properties. This study focused on the diversity of the bacteria present in aged refuse by DNA extraction. The PCR amplifier was used for DNA sequencing using DNA Polymerase primer. For PCR amplicons purification, amplicons were extracted from 2% agarose gels and purified using DNA Gel Extraction Kit while quantification was done using QuantiFluor™ -ST. Sample libraries were pooled in equimolar and paired-end sequenced on an Illumina MiSeq platform while Raw fastq files were demultiplexed, quality-filtered using QIIME. The taxonomy of each 16S rRNA gene sequence was evaluated by RDP using confidence threshold of 0.7 while operational Units (OTUs) were clustered with 97% similarity cut-off using UPARSE. The result revealed twelve phyla clusters which include; Firmicutes, Chloroflexi, Proteobacteria, Actinobacteria, Acidobacteria, Bacteroidetes, Planctomycetes, Nitrospirae, Cyanobacteria, Latescibacteria and Gemmatimonadetes. Furthermore, additional group classification revealed up to 513 reads of bacteria kingdom with dominant family classification of Anaerolineaceae, Ruminococcaceae, Nitrosomonadaceae, Planctomycetaceae, Clostridiaceae, Beijerinckiaceae, Xanthobacteraceae, Veillonellaceae, Gemmatimonadaceae. The presence of such diverse organisms in the aged refuse biofilter, show that the aged refuse biofilter has biodegradation potentials when treatment conditions are efficiently optimized.

Keywords: Diversity, microbial community, aged refuse biofilter, Commamox, nitrification, metagenomics.

27. CAFEi2020_080_103

Response surface methodology for the extraction of bioactive compound from black glutinous rice

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Abstract

This study was aimed the extraction of total phenolic compounds, as well as, the antioxidant activity of black glutinous rice (*Oryza sativa* L.). Three varieties of black glutinous rice consist of Leum Pua, Doi Saket, and Phayao were extracted using citric acid solvent. The influences of temperature, time and pH value on total phenolic contents and antioxidant activity (percentage of inhibition of DPPH free radical) were investigated. A central composite design as employed to determine the optimum extraction condition to obtain the highest total phenolic contents and antioxidative activity. The regression models of phenolic content were significant ($p \leq 0.05$) and determination coefficients values were 0.8028, 0.8089, and 0.8603 of Leum Pua, Doi Saket, and Phayao, respectively. The regression models of DPPH inhibition were significant ($p \leq 0.05$) and determination coefficients values were 0.8084, 0.8928, and 0.8243 of Leum Pua, Doi Saket, and Phayao, respectively. The selected optimum conditions were 72°C, 91 min at pH 1.44 for Leum Pua, 72.5 °C, 83 min at pH 1.39 for Doi Saket, and 66.3°C, 75 min at pH 1.32 for Phayao. Under the optimum condition, total phenolic contents and percentage of inhibition of DPPH free radical of extract from Leum Pua, Doi Saket and Phayao were 0.3814 mgGAE/g with 89.37%, 0.2607 mgGAE/g with 73.33, and 0.2617 mgGAE/g with 75.27%, respectively. The results showed that the total phenolic contents of the extract indicated a highly positive correlation with antioxidant activity.

Keywords: Black glutinous rice, total phenolic compound, antioxidative activity, solvent extraction, response surface methodology.

28. CAFEi2020_084_077

Feasibility study of 3D printed materials for an ammonia emission passive sampler

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Abstract

Ammonia (NH₃) emission accounts for a loss of 10 to 60% of the total nitrogen input in rice fields. NH₃ in the air reacts with sulphuric acid, nitric acid and hydrochloric acid to form ammonium salt, which increases the concentration of PM_{2.5} particles in the atmosphere. These fine particles can cause respiratory problems. A reliable NH₃ sampler is important in order to quantify the NH₃ emission. The objective of this study is to evaluate the suitability of three 3D printed materials, namely acrylonitrile-butadiene-styrene (ABS), polylactic acid (PLA) and polypropylene (PP) compared to stainless steel and glass, as the interior material of an NH₃ passive sampler for use with the chemical-trap approach; Stainless steel and glass are typically used for construction of the NH₃ passive sampler. The sample plates were coated with acetone with 3% oxalic acid and tested in closed static chambers with three different NH₃ sources. ABS, PP and PLA tolerated the acetone solution with PP being the least reactive. However, PP heavily warped during 3D-printing resulting in a deformed shape. Performance of coated ABS plates in trapping NH₃ is similar to stainless steel and glass plates.

Keywords: Ammonia volatilization, passive sampler, 3D printing

29. CAFEi2020_085_079

Adoption of precision agriculture by detecting and spraying herbicide using UAV

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Abstract

Farmers are facing the VUCA environment (volatile, uncertain, complex and ambiguous) and data indicating the contribution of farming to India's GDP has come down from 52% to 18% between 1951 and 2018, which is alarming. At this juncture, developing countries like India, where over 70% of the rural people depend upon the agriculture fields, adoption of disruptive technology (creative destruction) becomes the need of the hour, to enhance the crop yield and quality. Weeds are one of the major issues which severely affect the crop output. Unmanned Aerial Vehicle (UAV) or drone is recommended, to address the problem. Globally, the market for agriculture drones to move from \$1.3 billion to \$ 6.52 billion by 2026. Globally agriculture is the second largest industry after construction in terms of drone adoption. But Indian farmers have difficulty in adopting (or) procuring UAV's, as the size of their farm is small, income is very less. Other problems associated with the adoption of UAV include knowledge transfer and training to farmers, service support and maintenance cost. DaaS(Drone as a service) model is proposed, for rural areas. This paper aims to focus on weed management by providing a safer and cost-effective solution. By integrating technologies like visible light(VIS), near-infrared(NIR) light on an Unmanned Ariel Vehicle along with a precise sprayer and a weed detection system backed up by a lithium-ion battery(for longer flight duration), can help the process of spraying weedicide efficiently. The accuracy of the tested model is 92.6% for far away detection module and 95.4 for close range detection. UAV's with sprayer protects the farmer and consumers from odor and side effects.

Keywords: Drones, KNN, OpenCV, Agriculture 5.0, United Nations Sustainable Development 2030(UNSD), Trans Disciplinary Approach, DisTA

30. CAFEi2020_087_082

3D food printing as a promising tools for food fabrication: 3D printing of chocolate

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Abstract

The optimisation of printing dark chocolate was investigated, which included 3D printer modification. The modification comprises development of custom printer bed an inbuilt water recirculation system with a slow flow rate of 6.3 mL/s to avoid vibration. Additionally, a fan was attached to enhance the solidification of chocolate. It was found that 32 °C was the optimal condition of chocolate melting and this temperature was applied in the printing process. The addition of the support structure on the mechanical properties of chocolate such as cross and parallel support structures printed in a hexagonal shape was also investigated. Findings indicated that the cross support increased the stability and strength (57.5 ± 4.8 N) of chocolate more than the chocolate printed with parallel support (50.5 ± 2.7 N) and without any support structure (12.6 ± 6.1 N). Different infill structures (infill pattern and percentage) can contribute to the textural modification of 3D printed chocolate. The appearance of the 3DP construction was vital as this modality can influence the acceptability of the product. Sensory analysis was conducted among 30 semi-trained panellist. Most participants favoured the appearance of sample 3DP100%_IP (1.33) to those of samples 3DP25%_IP (2.00) and 3DP50%_IP (2.67). On the textural perspectives, consumers indicated their potential preferences on chocolate printed with 25% infill percentage. Similar results from consumer paired-preference test were obtained. These results suggested that consumer realised the potential of 3D printing for textural modification.

Keywords: 3D printed chocolate, infill pattern, infill percentage, texture modification

31. CAFEi2020_089_093

Optimization of soaking treatment on the quality of *Pangasius* fillet

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Abstract

Tra catfish (*Pangasius hypophthalmus*) is endemic to the waters of Mekong basin in South-East Asia. The Pangasius fillet has high demand in the international market due to its tender flesh, delicate taste and as an affordable substitute for cod and other more expensive white fishes. In Pangasius fillet industries, soaking fillet with food additives such as sorbitol, sodium tripolyphosphate (STPP) and sodium chloride (NaCl) is a common practice to increase yield, texture and possibly prolong the shelf life of the product. Therefore, this research aimed to establish the optimum concentration of sorbitol (1.32-4.68%), STPP (0.32-3.68%) and NaCl (1.32-4.68%) by response surface methodology and optimum soaking time of 15-60 min. The combination of the soaking solution was significant ($P < 0.05$) on pick-up mass, pH and water activity. The optimized condition for soaking was NaCl 1.32%, STPP 1.88% and sorbitol 4.68% for 30 minutes that can give a significant effect ($P < 0.05$) to the quality for Pangasius fillet. The optimized concentration and time of soaking can be considered as a practical pretreatment to improve the quality of Pangasius fillet either for fresh, chilled or frozen storage.

Keywords: *Pangasius* fillets, phosphate, soaking conditions, soaking time, sorbitol, sodium chloride

32. CAFEi2020_094_097

Rainfall-runoff models with fractional derivatives applied to Kurau river basin, Perak, Malaysia

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Abstract

Kurau River Basin (KRB), which covers an area of 322 km² and is the main drainage artery pouring into Bukit Merah Reservoir (BMR), is located in Perak State of Malaysia. The study of rainfall-runoff processes in KRB is important because BMR plays a vital role in rice production, flood control, ecosystems, and tourism in the region. This study proposes a new approach to rainfall-runoff modeling based on the fractional calculus. A dataset of daily rainfall and streamflow has been acquired. Then, the standard linear autoregressive with exogenous input (ARX) model is identified from the dataset in the sense of least square error. We consider the ARX model as a discretized differential equation with fractional orders. Such a model with fractional derivatives is versatile to represent hysteresis, which is intrinsically linked to the real runoff processes in tropical catchment basins like KRB.

Keywords: Runoff analysis, ARX model, Fractional calculus, Malaysia.

33. CAFEi2020_095_194

The optimisation of carbon sources in sustainable biosurfactant production using general algebraic modelling system

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Abstract

Biosurfactants are surface active agents that been synthesized by microorganisms naturally. They are consisting of both hydrophilic and hydrophobic parts in their general structures which can decrease the surface tension between two distinct stages or the liquid interfacial tension between water and oil. By having this feature, these natural surfactants have proven that they are more advantageous compared to the synthetic surfactants. However, these compounds unable to beat synthetic surfactants in term of production cost. In order to boost the output of biosurfactants, there are several options that can be carried out such as developing more economical manufacturing method and use the cheaper substrates during the process. The use of raw materials from agro-waste, hydrocarbon or by-products of process is one of the alternatives in offering a culture medium with carbon sources and, at the same moment, can be cost-effective in generating the biosurfactants. From this research, the potential carbon sources were evaluated to be used in biosurfactant production. To achieve the purposes of experiment, a mixed integer linear programming (MILP) model was created to select the suitable carbon origin. The software General Algebraic Modelling System (GAMS) is chosen as an optimization instrument in developing the desired models.

Keywords: Biosurfactant, natural surfactant, synthetic surfactant, MILP, GAMS

34. CAFEi2020_096_116

Development of smartphone-based imaging techniques for the estimation of chlorophyll content in lettuce leaves

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Abstract

Leaf color is a good indicator of plant's health status. In this study, a new image acquisition techniques was developed to estimate chlorophyll content of lettuce leaves. The images of lettuce leaves grown under artificial light were acquired using a smartphone. Leaves images was captured by directly attached the leaves to the camera lens with the aid of background illumination from SMD LED. Red, green, blue (RGB) color indices were extracted from leaves color images and some vegetation indices were also calculated. Then, the correlation between these indices and chlorophyll content obtained from SPAD-502 chlorophyll meter were evaluated. Significant correlation were found between all the image indices and chlorophyll content with the R^2 ranging from 0.63 to 0.85 except for G and B indices from RGB component. Highly significant correlation was found between vegetation indices (VI) with R^2 of 0.85 and had the lowest root mean square error (RMSE) of 8.07 g of chlorophyll/100 g fresh tissue. This demonstrated that the chlorophyll content of lettuce leaves can be successfully estimated using regular smartphone with added background light illumination from SMD LED.

Keywords: color image processing, color indices, leaves color, chlorophyll content

35. CAFEi2020_097_089

Optimizing Hydrogen Production from the Leachate Landfill by Electro-Coagulation Technique

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Abstract

The loss and impact of non-renewable fossil energy on global warming concerns are prompting to intensive research to find viable, less emissions-oriented alternative energies. The present work aims to study the potential of hydrogen gas production (for renewable energy) by electrocoagulation process from landfill leachate. The central composite design from response surface methodology (RSM) software was implemented to investigate the process variables in the hydrogen production system. The effects of three independent variables; namely pH (4-8) and voltage (3-9 V), using different types of electrodes (Al, Fe, and Ni) were studied. At the optimal condition of voltage 9V and initial pH 6 at 20 minutes, the Al electrode recorded an upturn maximum H₂ yield of 697 ppm, while 554 and 551 ppm were obtained with Ni and Fe electrode, respectively. Moreover, the coefficient of determination (R²) showed a good relationship between actual and expected results.

Keywords: Optimization; Electro-Coagulation; Hydrogen gas; landfill leachate; response surface methodology (RSM)

36. CAFEi2020_098_090

Improvement of roasted germinated brown rice flour processing using ergothioneine to limit oxidation during processing and preservation

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Abstract

Roasting temperature and time are important parameters in the process of roasted germinated brown rice flour (RGBRF), which cause the loss of bioactive ingredients and sensory value of the product. During roasting and storage, fat oxidation is also one of the problems that reduce the quality of RGBRF. In order to complete the RGBRF process, the experiments that using different temperature and time as 160°C, 200°C, 240°C for 10 to 30 minutes were done to find the best roasting conditions. To limit the oxidation of fat during the processing and preserving RGBRF, ergothioneine (ERG) extract from enoki mushroom were supplemented at 3%, 5%, 7% and 10% (w/w) before roasted, the product was then ground and put into two types of packaging (PA and aluminum), vacuum seamed and stored at room temperature for 8 weeks were carried out. The results showed that germinated brown rice (GBR) which supplemented 3% of the extract before roasted at 200°C for 30 minutes showed the best quality in term of sensory value, γ -aminobutyric acid (GABA) content and helped to limit fat oxidation as well as maintained stable quality after 8 weeks of storage in PA and aluminum packaging. In addition, the results from *in vitro* of starch resistance and *in vivo* of sugar absorption capacity in rats showed that RGBRF did not significantly change the GI index as well as the ability to absorb sugar compared to unroasted product. The results indicated that RGBRF should be used as a nutritious food with the ability to supplement bioactive compounds to the people at risk of lifestyle diseases.

Keywords: Ergothioneine, enoki mushroom, γ -aminobutyric acid, *Flammulina velutipes*

37. CAFEi2020_099_092

Screening for vitamin, mineral and antioxidants in selected vegetables, fruit and grains for elderly

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Abstract

Undernutrition and micronutrient deficiency are common problem in elderly, thus screening of natural food source for product formulation is important to ensure proper nutrition in older people is maximise. Selected vegetables, fruit and grains namely red amaranth, green spinach, barley, corn, pineapple and Anggun sweet potato were screening for vitamins, minerals and antioxidants. Red amaranth is a good source of vitamin C (375 mg/100g), Vitamin A (3734 ug/100g), vitamin B complex, and zinc (12.2 mg/100g). Corn and barley supply minerals such as zinc (2.65 mg/100g, in corn) and selenium (50 ug/100g in barley), while pineapple is rich in vitamin C (207.16 mg/100g) . Total phenolic content (TPC), 2,2-diphenyl-1-picrylhydrazyl (DPPH) and ferric reducing antioxidant power (FRAP) assay had been used to determine antioxidant activity in all samples. The highest radical scavenging activity (DPPH) was found in pineapple, green spinach contained the highest amount of FRAP and the highest TPC was found in germinated corn at 72 hours. From this study it can be concluded that combination of vegetables, fruit and grains during food product formulation could provide enough Recommended Nutrient Intake (RNI) for elderly to maintain healthy life.

Keywords: Vitamin, mineral, antioxidant, vegetables, elderly.

38. CAFEi2020_100_095

Effect of lemongrass and mint essential oils combined with food additives soaking solution on the quality of *Pangasius* fillets during cold storage

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Abstract

Pangasius fillet has high demand in the international market due to its tender flesh, delicate taste and as an affordable substitute for cod and other more expensive white fishes. From the previous study, it was found that the optimized condition for soaking was NaCl 1.32%, STPP 1.88%, and sorbitol 4.68% for 30 minutes which give a significant effect ($p < 0.05$) to the yield, water activity, pH, and improvement in the sensory of treated fillet. However, the soaking itself was not contributed to the extension of shelf life. Lemongrass essential oil was showing the best result in improving the quality and shelf life of *Pangasius* fillet stored in refrigerated storage (0-4°C). The addition of 0.2% lemongrass was showing shelf life extension 7 days or longer compare to fillet without soaking and fillet soaking without essential oil. In addition, it also reduces the Total Volatile Based-Nitrogen (TVB-N) content, improve the sensory quality (raw and cooked) of *Pangasius* fillet. Mint essential oil was showing the shelf life extension (7 days longer) and sensory improvement at 0.3% concentration. However, mint essential oil was not showing better TVB-N reduction in treated fillet compares to fillet soaking without essential oil. Therefore, it is recommended to incorporate 0.2% lemongrass essential oil for the *Pangasius* industry to extend the shelf life of *Pangasius* fillet followed with quality improvement.

Keywords: lemongrass essential oil, mint essential oil, *Pangasius* fillets, shelf life

39. CAFEi2020_100_096

Optimization of soaking treatment on the quality of *Pangasius* fillet

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Abstract

In *Pangasius* fillet industries, soaking fillet with food additives such as sorbitol, sodium tripolyphosphate (STPP) and sodium chloride (NaCl) is a common practice to increase yield, texture and possibly prolong the shelf life of the product. Therefore, this research aimed to establish the optimum concentration of sorbitol (1.32-4.68%), STPP (0.32-3.68%) and NaCl (1.32-4.68%) by response surface methodology and optimum soaking time of 15-60 min. The combination of the soaking solution was significant ($p < 0.05$) on pick-up mass, pH and water activity. The optimized condition for soaking was NaCl 1.32%, STPP 1.88% and sorbitol 4.68% for 30 minutes that can give a significant effect ($p < 0.05$) to the quality for *Pangasius* fillet. The optimized concentration and time of soaking can be considered as a practical pre-treatment to improve the quality of *Pangasius* fillet either for fresh, chilled or frozen storage.

Keywords: *Pangasius* fillets, phosphate, soaking conditions, sodium chloride, sorbitol.

40. CAFEi2020_103_102

Improvement of cosmeceutical properties in rice by-products by solid state fermentation with *Aspergillus oryzae* and effects of different extracting conditions

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Abstract

Rice milling generates a lot of rice by-products and they are commonly used as animal feed ingredient. However, they actually have high cosmeceutical values, attributed to their high content of bioactive compounds. In the present study, rice by-products (broken rice and rice bran) were subjected to solid state fermentation (SSF) using *Aspergillus oryzae* at 30°C for 12 days and their cosmeceutical potentials were then evaluated. Different extraction conditions such as type of solvent (water, 50% ethanol) and extraction temperature (30°C, 40°C) were also optimized using a one-factor-one-time approach. Through tyrosinase inhibition assay, it was observed that SSF has improved the anti-pigmentation effect of broken rice and rice bran 7.4-fold and 11.2-fold in comparison to their unfermented substrate, respectively. SSF has also improved anti-aging effect on broken rice and offered 6.6-fold of improvement in fermented rice bran. In extraction optimization studies, stronger anti-aging effect was observed in the water extract of both fermented substrates extracted at 40°C while the anti-pigmentation effect is stronger on 50% ethanol extract of both fermented substrates also at 40°C for rice bran, and 30°C for broken rice. Most phenolic acids that are commonly related to cosmeceutical purposes were detected in the extracts of both fermented substrates while most of the organic acids were detected in the water extract. Our study suggests that SSF using *A. oryzae* could improve the cosmeceutical activities of rice by-products, and both water and 50% ethanol extracts have high potential to be developed as cosmeceutical bio-ingredients.

Keywords: *Aspergillus* fungi, cosmeceutical, extraction, rice bran, rice by-products, solid-state fermentation

41. CAFEi2020_106_106

Food and agricultural waste management

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Abstract

Today we are deeply concern with sorrow to say that those farmers that have been our main FOOD BASKET are suffering from hunger, poverty, hand to mouth and ignorance of civil society and governments in many countries. Nowadays, global farming and agriculture are decreasing day by day at lowest level in the second decades of 21st century. Majority of small farmers are impelled to drop out their ancient profession. Young generation and children of farmers are looking for new areas of job for living as they do not find better future in agriculture. Global warming and environment problems have direct and indirect impact on agriculture. The wise strategy must be taken with multi layered solutions for food and agricultural management, one of it being the management of waste for food and agriculture. Japanese technology is aiming for food and agricultural waste management at lowest cost and environment friendly.

Keywords: waste management, cost effective

42. CAFEi2020_120_146

Spatial variability of soil erodibility in response to different agricultural land use at highland farms

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Abstract

This work describes the effect of different agricultural land use on potential soil erodibility (K) at cultivated farming areas in Cameron Highlands. Ordinarily, soils are assigned with K factors depending on geological properties only which can result into erroneous calculation of soil erosion. This study explores roles of different agricultural land use on the spatial variability of soil erodibility on hilly farms at Cameron Highlands. Soil samples, slopes and spatial locations were collected based on crop types being cultivated. Meanwhile, the land use and type of equipment for each crop are recorded and ranked depending on the degree of soil disturbances. The results showed that, K values are ranged from 0.0084 to 0.0161. Shallow-root crops, such as vegetables and flowers have higher K values due to shallow soil rootzone and frequency of surface operations. However, tea cultivated areas and forests have low K values, indicating comparably higher ability to resist erosion. Furthermore, the erodibility factor for tea farms shows increasing patterns along the developmental stages while the reverse was found in vegetable farms. Spatial variability of the K is influenced by various farming operations at different growing stages and the peculiarity of each crop. This work demonstrated that, the soil erodibility factor can be determined considering the crops and stages of development, in addition to geological attributes.

Keywords: Cameron Highlands, farming operations, pedotransfer function, soil erosion, tillage

43. CAFEi2020_121_118

Optimization of neural network weights using hybrid method of genetic search algorithm and RSM: Application to spray drying of coconut milk

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Abstract

In this study, a comparative study was performed between ANN and GA enhanced ANN to estimate their abilities in emulating the spray drying process of coconut milk powder under restricted parameters. The weight performance of the neural network is optimized using genetic algorithm parameter selection through response surface methodology. GA parameter such as population size, mutation and crossover are optimized and is used for the development of GA-ANN network. The optimized GA parameters values are at maximum population size (100), minimum crossover rate (0.2) and maximum mutation rate (1.0). The optimized GA parameters is then applied in the development of the GA-ANN network as the networks applied genetic algorithm to determine the optimized weights in its neural network. Both models are then compared by placing importance of high R^2 and low MSE values. The results have shown GA-ANN's MSE (0.033396) is lower than ANN's MSE value (0.082263), which the GA-ANN's R^2 value (0.88245) is higher than ANN (0.8499). This shown that GA as a global search technique can be integrated in the development and increase the emulating ability of the ANN.

Keyword: Neural network, Genetic Algorithm, spray drying, coconut milk, Optimal Weights

44. CAFEi2020_124_119

Roasted coffee beans' quality: A review

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Abstract

Coffee aroma compounds are one of the roasted coffee bean quality signatures and have played a major role in establishing the popularity of coffee beverages worldwide. The formation of coffee aroma happened during roasting, where the green beans were exposed to the hot air (200 - 240 °C) for 10 to 15 minutes or until it became roasted/dark brown coloured. During coffee bean roasting, the temperature of hot air and roasting time are two important process variables that could be used to control the roasted coffee bean quality. Coffee quality, on the other hand, can be determined using its colour, moisture content, antioxidant activity and sensory evaluation. This review will cover these 4 sub-topics, with the aim to summarise the relationship between roasting conditions and coffee qualities.

Keywords: coffee beans quality, roasting condition

45. CAFEi2020_125_121

Effects of drying methods on the physicochemical properties of powder made from different parts of pumpkin

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Abstract

Pumpkin (*Cucurbita* sp.) is a widely consumed fruit as it has high carotenoid content and medicinal value; but it has a relatively short shelf life and deteriorates due to microbial spoilage. Various drying techniques are being introduced to the industry to preserve pumpkin-based products. During drying process, products are prone to serious decay caused by changes in temperature, thus affecting the physical or chemical properties of the product. The objective of this study is to determine the effects of drying methods on the physical properties and proximate composition of pumpkin powder produced from different parts of the fruit. Samples were made using unpeeled pumpkin and parts of the fruit; skin, flesh, and seed, and were dried using different drying methods utilising oven (80 °C), rapid hot air (80 °C) and freezer (-110 °C). The dried samples were then grounded and sieved approximately 250µm and 710µm in diameter. Practice of different drying methods was found to have significant influence on physical and chemical properties of the samples ($p < 0.05$). Rapid hot air drying showed good impact on production of pumpkin powder with moisture content of 5.61-6.89%, particle size of 122.98-256.46 µm, and density of 304.80-724.69 kg/m³. These results obtained from rapid hot air drying method have proven to be better than that of the freeze drying method. Proximate composition values of rapid hot air dried samples were also found to be better than the oven drying method with protein content of 9.86-31.54% and fat content of 3.88-34.93%. In conclusion, rapid hot air drying method is acceptable for the production of pumpkin powder with better physical properties and proximate composition. To reduce wastage, different parts of pumpkin could also be used for powder production. It is recommended that the technique is applied in large scale productions of high quality powder products in the future.

Keywords: rapid hot air drying, pumpkin powder, freeze drying

46. CAFEi2020_128_122

Effects of maltodextrin on the physical properties of canola oil-based ice creams

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Abstract

Recent trend in production of healthy food products has stimulated ice cream manufacturers to minimize the saturated fat content by replacing it with high-unsaturated fat or oil such as canola oil, yet maintaining the physical properties of the end product. Addition of maltodextrin (MD) into the formulation may assist in obtaining the desirable physical properties. Therefore, the objective of this study was to develop hard ice creams containing different ratios of canola oil and MD. Four ice cream formulations were prepared by weight: MD-0 (5% oil, 0% MD), MD-1 (4% oil, 1% MD), MD-2 (3% oil, 2% MD), and MD-3 (2% oil, 3% MD). Both MD-2 and MD-1 exhibited the highest ($45.05 \pm 4.28\%$) and the lowest ($32.49 \pm 1.20\%$) overrun, respectively, yet there was no significant difference ($p > 0.05$) between all ice creams in terms of hardness (3.20-4.79 kg). Additionally, there was no significant difference ($p > 0.05$) between MD-0, MD-1, and MD-2 in their melting rates which were significantly slower ($p < 0.05$) than those of MD-3. In overall, decreasing the amount of oil (i.e. increasing amount of MD) resulted in significant ($p < 0.05$) increase in overrun, yet had no significant ($p > 0.05$) effect on the ice cream's hardness and melting rate except for MD-3 for the latter. The ice cream that exhibited the most desirable physical properties was MD-2 (overrun, $45.05 \pm 4.28\%$; hardness, 3.73 ± 0.75 kg; slowest melting rate). This finding highlighted the potential of MD in providing desirable texture to the ice creams to certain extent. Future studies are recommended in maintaining the ice cream's flavour and physical properties upon storage, and in determining its sensory acceptability among consumers.

Keywords: Canola oil, fat, ice cream, maltodextrin, physical properties.

47. CAFEi2020_129_123

Biomass and yield estimation of MR219 and MR220 of paddy varieties using terrestrial laser scanning data

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Abstract

Rice (*Oryza Sativa L.*) is the main food source in Malaysia. Thus, to fulfill the needs, continuous rice production is required. Appropriate amount of nitrogen (N) fertilizer is needed to ensure high production of rice. In this research, the effect of N to plant height, SPAD reading, biomass and yield were firstly studied. It was later followed by the estimation of biomass and yield using Terrestrial Laser Scanning (TLS) data. Different amount of N i.e. 0 kg/ha, 85 kg/ha, 170 kg/ha and 250 kg/ha were applied to MR 219 and MR 220 paddy. The 2-way ANOVA results showed that all parameters were significantly different at each N level. The highest reading was achieved at 250 kg/ha of N level; 70.46 cm (plant height), 39.13 (SPAD reading), 927.29 g/m² (biomass) and 830.99 g/m² (grain yield) respectively. Therefore, these parameters can be used to indicate the level of input nitrogen at the plant. Later, the plant height calculated using developed Crop Surface Model (CSM) of the Terrestrial Laser Scanning (TLS) data was used to evaluate the biomass and grain yield of paddy. Results has shown that high correlations and regression were accomplished for CSM plant height and biomass ($R^2 = 0.809$). However, the results between CSM plant height and grain were lower ($R^2 = 0.582$). In accordance with the outcome, biomass and yield were best estimated at 94 Day After Sowing (DAS). An estimation model for biomass and grain yield using linear equation was developed. Then a t-test was done to test the estimated and measured biomass and grain yield. The outcome showed that there was no significance difference between measured and estimated values. The values for both parameters were 1 ($p \geq 0.05$). Thus, it can be said that CSM plant height can be used to estimate biomass and grain yield.

Keywords: biomass, yield, height, phase shift, laser scanner

48. CAFEi2020_130_124

Detecting BSR-infected oil palm seedlings using thermal imaging technique

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Abstract

Basal Stem Rot (BSR) is the most destructive disease instigated by a white wood rotting fungus called *Ganoderma boninense*, which cause great economic setback in oil palm productivity. It attacks the basal stem of oil palm trees, causing them to slowly rot. It also affects the xylem tissues that eventually interrupt water transportation to the upper part of the oil palm, turning the leaves at the frond become yellow. This problem should be prevented during nursery stage by separating between healthy and BSR-infected seedling. Therefore, this study focuses on the potential use of thermal imaging for detecting BSR in oil palm at seedling. Thermal images of oil palm seedling from healthy and BSR-infected were captured and processed to extract several thermal properties of the seedling, i.e. maximum, minimum, mean and standard deviation of pixel intensity value. These values were then undergone statistical analysis to identify its significant different in differentiating healthy and BSR-infected seedling. Several classification models were tested including Linear Discriminant Analysis (LDA), Quadratic Discriminant Analysis (QDA), Support Vector Machine (SVM) and k-Nearest Neighbour (kNN). Principal Component Analysis (PCA) was used to reduce the dimensionality of the dataset. The results demonstrated that the highest accuracy achieved at 80.0% using SVM (fine gaussian) classification model with PC1 and PC3 as the input parameter. This summarizes the potential of thermal imaging in detecting BSR-infected oil palm trees at seedling stage.

Keywords: BSR, oil palm, thermal imaging, image processing, machine learning.

49. CAFEi2020_132_128

Differences between healthy and *Ganoderma boninense* infected oil palm seedlings using spectral reflectance of young leaf data

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Abstract

Ganoderma boninense (*G.boninense*) is the causal agent of basal stem rot (BSR) which significantly reduced the productivity of oil palm plantations in Southeast Asia. At early stage, the disease did not show any physical symptoms that could be seen with naked eyes resulted in detection difficulties. To date, there was no effective detection for this disease, and conventional methods such as manual and laboratory-based required trained specialists as well as time-consuming. Therefore, this study was conducted using hyperspectral remote sensing to investigate the differences in spectral reflectance of young leaf (frond one (F1)) of healthy and *G.boninense* infected oil palm seedlings. The seedlings were inoculated with *G.boninense* pathogen at five months old. At five months after inoculation, 558 spectral signatures of F1 were extracted from acquired hyperspectral images. Noise removal was done to the extracted spectral signatures to remove outliers in the data. Then, the spectral signatures were averaged and plotted to observe the differences. Differences in reflectance of healthy and *G.boninense* infected seedlings were seen evidently in the near-infrared (NIR) region. Thus, this study showed evidence that F1 spectral reflectance has the ability to detect early stage of *G.boninense* infection at oil palm seedlings.

Keywords: *Ganoderma boninense*, BSR disease, Hyperspectral imaging, Oil palm seedlings, Spectral reflectance

50. CAFEi2020_133_126

Physicochemical properties of shortenings based on red palm olein for sandwich cookie cream formulation

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Abstract

Sandwich cookie cream (SCC) formulation consists of 20-40% (w/w) fat which is important in providing good melting properties in mouth and elevating better flavour-release. Palm-based fats such as red palm olein (RPOL), palm oil (PO) and palm stearin (PS) are potential fat components to produce shortening for SCC with desirable physicochemical properties. Therefore, the objective of this study was to develop and characterize palm-based shortenings for SCC based on RPOL, PO and PS at different ratios (by weight) of 0:50:50 (SH-0), 5:45:50 (SH-5) and 10:40:50 (SH-10). The SH-0 contained highest amount of saturated fatty acid (SFA, 56.21±0.39%) and exhibited the hardest texture (117.71±1.07N) with poor creaming performance as compared to SH-5 and SH-10. On the other hand, both SH-5 and SH-10 exhibited the lower iodine values (IV) of 44.67 and 45.88, respectively, besides showing better creaming performance than that of SH-0. In overall, increased in the amount of RPOL resulted in significant ($p<0.05$) decreased in SFA, IV and hardness, yet increased the creaming performance of the shortenings. Both SH-5 and SH-10 exhibited the most desirable physicochemical properties which resembled those of commercial shortening sample. It is recommended for future studies to develop more palm-based food products based on RPOL as healthier food choices for consumers.

Keywords: Palm oil; palm stearin; red palm olein; sandwich cookie cream; shortening

51. CAFEi2020_136_130

Sorption characteristic of starch-based film

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Abstract

Moisture sorption characteristic is important for determining the stability of bio-based plastic during packaging and storage condition. This study was carried out to investigate the moisture sorption characteristic of starch-based film. Moisture sorption test were conducted at different temperature (5, 30 and 50 °C) and relative humidity (23-75%). The experimental data was fitted using several models. Based on the Peleg model, the maximum rate of absorption and absorption capacity occurred at higher relative humidity. Guggenheim Anderson de Boer (GAB) model was the most suitable model to fit the experimental isotherm data and it is useful to predict the water sorption properties of film which relate to different relative humidity condition. In addition, the shelf life of film was reduced when placing under lower temperature due to the higher sorption capacity of moisture.

Keywords: Moisture sorption; Starch-based film; Isotherm model

52. CAFEi2020_143_136

Adaptive performance evaluation of IAR-sorghum thresher for two varieties of wheat

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Abstracts

With the aim of providing a multi-crop thresher to local farmers, the IAR-Sorghum thresher was evaluated using varieties of wheat. Among the factors which were varied in the Randomized Complete Block Design experiments used in the evaluation were 2 levels of Moisture Content, 2 levels on Feed Rate, 3 levels of Cylinder Speed and 3 replications of each treatment. The indices used to measure the effectiveness and efficiency of the thresher to process wheat were threshing efficiency, cleaning efficiency, scatter loss from thresher and its output capacity. The fuel consumption rates of carrying the tasks out were also determined for the 2 moisture contents of each variety. These indices translate into the economics qualities and quantities which would influence the acceptance or other of the thresher by targeted farmers. It was found that the thresher could thresh the crop to a threshing efficiency of 95%, cleaning efficiency of 82%, scatter loss of 10% achieved by the thresher was rather high, and the output capacity of 9 kg hr⁻¹ was not satisfactorily. Hence, the recommendation on how to improve on the thresher performance and the rate of fuel consumption were provided.

Keywords: Threshing Efficiency, Cleaning Efficiency, Scatter Loss, Throughput Capacity, Hard Red Winter Wheat and Hard White wheat.

53. CAFEi2020_145_137

Development of a machine vision system for rice seed inspection system

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Abstract

Rice seed production in Malaysia is greatly dependent on the purity of the cultivated paddy seed produced through the government certified paddy seed program. The seeds to be marketed by the seed processors must undergo quality control protocol where the seed lots are sampled from the seed farms and seed processing plants for purity analysis by the enforcing agency at the Seed Testing Laboratory of the Department of Agriculture (DoA). The current inspection conducted by the laboratory is based on manual process, which is laborious and time consuming. Therefore, a prototype (Patent ID: PI2018500018) of a machine vision-based rice seed inspection system (RiSe-IViS) was developed to explore the possibility of replacing the existing manual method in distinguishing the weedy rice and cultivated rice seeds under the Standard Jabatan Pertanian Malaysia (SJPM) standard protocol with a modern, effective and efficient technique using an image processing approach. The developed RiSe-IViS prototype consists of two parts i) hardware configuration and ii) software development. This paper discussed the criterions to be established, challenges and limitation encountered in developing the hardware prototype involving the image acquisition setup, lighting configuration and seed plate design. The importance of each criteria to ensure its reproducibility are also discussed. Software programme was developed to assist user for image acquisition and analysis. The image processing steps undertaken in the programme are also discussed. The RiSe-IViS is expected to classify major rice seed varieties available in Malaysia against the weedy rice variants with superior accuracy.

Keywords: Machine vision, weedy rice, machine learning, image acquisition, image processing, classification

54. CAFEi2020_147_141

Effect of mild-temperature and high-temperature pasteurisation on physicochemical properties, bioactive compound, antioxidant activity and microbiological qualities of reconstituted pomegranate juice (RPJ)

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Abstract

Reconstituted pomegranate juice prepared from pomegranate concentrate, were analysed for microbial growth and changes in CIE Lab color, total phenols, anthocyanin and antioxidant capacity before and after pasteurisation. Two pasteurisation conditions were tested namely mild-temperature pasteurisation (MTP) at 80°C, 30 s and high-temperature pasteurisation (HTP) at 95°C, 30 s which is also normally practiced by industries. Both MTP and HTP showed effective inactivation of microbial growth to negligible level with MTP taking almost half pasteurisation-time (-46.3%) as compared to HTP, indicating possible less energy usage. Comparable pH, titratable acidity and total soluble solids were obtained for MTP and HTP with insignificant differences ($p > 0.05$). A significantly higher CIE a values and decrease in L and b were obtained for MTP-juice indicating increase in red tonalities due to increase in anthocyanin. Nonetheless, the changes in phenols and anthocyanin contents were not significantly affected by both MTP and HTP, although slight rise was observed for both pasteurisation treatment, with higher increase obtained for HTP than MTP. Antioxidant capacity measured using FRAP-assay was significantly influenced by thermal pasteurisation and have good correlation with those from DPPH assay results at the 90% confidence level ($p < 0.10$) and $r = 0.626$. This suggests that both treatment showed increase in reducing power and radical scavenging capacity.

Keywords: Antioxidant capacity, High-temperature pasteurisation (HTP), Mild-temperature pasteurisation (MTP), Physicochemical properties, Reconstituted pomegranate juice, Anthocyanin, Microbial load

55. CAFEi2020_148_169

Total Mercury in Rice Plant (*Oryza sativa*) and Associated Health Risks

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Abstract

Consumption of mercury-contaminated rice could pose a potential health risk to humans. In this study, total mercury (THg) concentrations in various parts (roots, stems, leaves, and grains) of rice plant (*Oryza sativa*) collected from Sekinchan, Selangor, Malaysia were analyzed for risk assessment. The collected samples were digested following USEPA Method 3050B and THg concentrations were analyzed by Direct Mercury Analyzer (DMA-80). The mean concentrations found in plant parts were as follows: root, 47.01±0.42 µg/kg; stem, 6.43±1.77 µg/kg; leaf, 26.25±4.71 µg/kg; grain, 2.64±0.42 µg/kg. THg distribution in rice plants was roots > leaves > stems and grains. The mean THg concentration in grain (2.64±0.42 µg/kg) was below the maximum permitted proportion stipulated by Malaysian Food Regulation 1985 (50.0 µg/kg). The estimated weekly intake (EWI) of THg through rice was 0.07±0.01 µg/kg bw/week for 60 kg adult, below than provisional tolerable weekly intakes (PTWI) as suggested by JECFA indicating unlikely to cause impairment of public health due to consumption of rice planted in this region. However, periodical monitoring of mercury pollution in Selangor area is crucial because mercury contamination in crops could jeopardize food safety and security.

Keywords: Estimated weekly intake; Hazard quotient; Health risk assessment; Rice plant; Total mercury

56. CAFEi2020_150_142

Physio-chemical properties of banana peel powder to functional food

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Abstract

Saba banana is one of the most favorites banana varieties in Malaysia. It also generates a concern amount of waste as the only value part is the pulp. Banana peel has been proven having a lot of nutritional content that should not be ignored and wasted. Conversion of banana peel to powder will convert it into a value added products in food industry. Preliminary study on the protein, moisture, crude fiber and fat were carried out for 2 different stages of maturity which are stage 2 and stage 5. Both stages have close difference value and hence stage 2 of banana was chosen for next analysis, due to the high waste of banana peel in stage 2 in SME (Small Medium Enterprise) in production of banana chips. In this study, Saba banana peels were process into powder at different range of size particles. This study characterized the banana peel powder for storage application at different size of particles. As the particles of the banana peel powder increases, the flow ability of the powder decreases. The green banana peel powder was chosen as the main subject of study to achieve other objectives by varying their size of particles. It was found that green banana peel (stage 2) at sample A (1-125) have the highest true density but sample C(>250) have the highest bulk density. The pH mean value of three size also ranging from 6.15 to 6.46. The powder's pH (6.15-6.46) is in standard wheat flour acidity range. Moreover, the study on the water holding capacity at different temperature identifies that banana peel powder has high water holding capacity that ranging from 3.83 to 6.45 g water/g dry sample. On the other hand the banana peel's oil holding capacity is low that ranging from 0.84 to 0.99 g oil/ g sample. These information were then used to identify types of food that is suitable for production industry. Identified the stage 2 of banana peel powder also showed that it has a water binding agent in food due to its high water holding capacity. It also has low oil holding capacity in which suitable for fried product. In short, this study is a succeed in identifying the potential of banana peel powder in food products based on its characteristics.

Keywords: Saba banana, banana peel, banana peel powder

57. CAFEi2020_152_145

Nonlinear growth dynamics of date palms responding to environmental parameters

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Abstract

Scientific analysis of plant growth helps in improving the efficiency of cultivation practices through optimization of their environmental conditions. The ultimate aim of this research is to derive optimal policy for better growth of date palms by considering its dynamical response to environmental parameters such as solar radiation, soil moisture, and temperature. Field experiments are conducted at an irrigation scheme located in the Jordan Rift Valley. A drip irrigation system is installed to water 10 trees of date palms either with fresh or saline water depending on the soil matric potential. The circumference of the trunk of a tree is measured using a dendrometer with a 30 minutes interval and recorded in a data logger. Environmental parameters including the soil matric potential, solar radiation, and soil temperature are also logged every 30 minutes. This study focuses on determining a nonlinear model representing the growth dynamics of the date palm tree responding to those environmental parameters. The linear regression is applied to estimating the kernel coefficients of discrete Volterra series modeling the time series. The non-linearity of the model is expected to explain diurnal shrinkage and swelling of the tree trunk under different environmental conditions.

Keywords: Date palm, dendrometer, drip irrigation, nonlinear dynamics, Volterra series

58. CAFEi2020_153-182

**Review on palm oil contaminants related to 3-monochloropropane-1,2-diol (3-MCPD)
and Glycidol Esters (GE)**

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Abstract

The issue of food safety is a major concern in the oil palm industry as it will affect national income. 3-MCPD and GE are contaminants that are formed during the refining of palm oil mainly in the deodorization step. Palm oil was reported to contain one of the highest levels of these contaminants amongst all vegetable oils. Both 3-MCPD and GE are characterized by the International Agency for Research on Cancer (IARC) as possibly carcinogenic to humans. Therefore, the oil palm industry must address this issue and find ways to comply with food laws, acts, regulations and standards enforced by local and international authorities. The aim of this review is to provide a comprehensive summary of the 3-MCPD and GE precursors and mitigation strategies to minimize the 3-MCPD and GE formation.

Keywords: 3-MCPD, GE, oil palm contaminants, heat-induced food toxicants, refined edible oils

59. CAFEi2020_154_144

Microencapsulation of *Bacillus subtilis* UiTMB1 by spray drying in the presence of molasses and soybean curd residue (okara) as nutrient sources

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Abstract

The present study focuses on development of suitable and reliable formulation of *Bacillus subtilis* UiTMB1 with low-cost substrates such as molasses and soybean curd residue (okara) using a spray drying technique. The molasses and bio-waste substrate okara were selected as carbon and nitrogen sources for the bacterial strain. In this study, 10 different concentrations of molasses from 1%–10% [w/v] were suspended in distilled water containing 10^6 CFU/mL of *B. subtilis* UiTMB1 and incubated for 24 hours. Out of 10 tested concentrations, 5% molasses that gave the highest bacterial cell production was selected for a subsequent experiment with okara powder in a basal salt solution. Three concentrations of okara powders which 0.5%, 1.5%, and 3.0% [w/v] were used to evaluate the optimal concentration of okara for the production of whole cells and the spore efficiency (%). In the results, the formulation of 5% molasses combined with 1.5% okara in basal salts solution has yielded 1.77×10^8 CFU/mL whole cells and 2.47×10^8 CFU/mL of endospores. The formulation also gave the highest spore efficiency at 92.7%. The effects of survivability (%) and the viability of spray-dried *B. subtilis* UiTMB1 were further evaluated upon incorporation with three different carriers of 10% magnesium sulphate (MgSO_4), 7.5% MgSO_4 + 2.5% okara, and 5% MgSO_4 + 5% okara for spray drying produced by the spray dryer with inlet temperature of $150 \pm 2^\circ\text{C}$ and outlet temperature of $80 \pm 2^\circ\text{C}$. Six months of storage at two different temperatures which were $4 \pm 2^\circ\text{C}$ and $24 \pm 2^\circ\text{C}$ for *B. subtilis* UiTMB1 formulation plus with carrier were evaluated for their viability during the storage. The finding showed that all carriers promoted 95.7%–93.2% of survivability of *B. subtilis* UiTMB1 after the spray drying process. However, significant reductions of bacterial colonies in all spray dried *B. subtilis* UiTMB1 formulations can be observed over the six months storage duration before constant at 10^7 CFU/mL.

Keywords: *B. subtilis*, carriers, molasses, okara, spray dried formulations, spray drying.

60. CAFEi2020_160_148

Effect of sweet potato flour substitutions on the quality characteristics of bread

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Abstract

This work describes the effect of incorporating a various proportion of purple-fleshed sweet potato flour (PSPF) (0 - 100%) to wheat flour (WF) on the quality characteristics of bread. The breads were evaluated for their physical characteristics (weight, height, loaf volume, specific volume, density, weight loss, colour and texture) and microscopic analysis. The loaf volume, specific volume and weight loss of bread found to decrease while the weight, height and density of bread found to increase as more PSPF incorporated in the formulation. The colour of the breads became darker with an increase of a* value as more addition of PSPF in the formulation. As the proportion of PSPF increase, the texture (hardness, chewiness and gumminess) of bread were also found to increase. The microscopic analysis showed that there was not much different in terms of porosity between 10% (w/w) addition of PSPF and 100% (w/w) WF in the bread formulation. The addition of PSPF between 30 and 100% (w/w) in the bread formulation resulted in the dense and coarse bread crumb. This work demonstrated that the application of PSPF has potential to be processed into flour and partially replaced for WF in bread preparation to improve the nutritional quality.

Keywords: Purple-fleshed sweet potato flour; Bread; Quality characteristics.

61. CAFEi2020_164_170

Discharge characterization and variability determination along shorter sections of soaker hose pipe for soil column experiment

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Abstract

Unlike other micro-irrigation facilities like a drip, trickle, and sprinklers that emits water at regularly spaced intervals with predefined discharges, porous rubber pipes (soaker hose) has openings of variable sizes that become unevenly spaced with uneven distribution. The latter makes discharge to be variant along its lateral. Shorter sections are used under laboratory column experiments of soil wetting pattern studies and for this reason, laboratory experiments were conducted to evaluate the extent of emission rates variability on short sections of commercial Irrigation Soaker Hose, 16 mm diameter. Three sections of 10 cm length pipes were randomly selected from 15 no's cuts from different parts of the twenty meters length pipe bundle and used to investigate the extent of variability on emission rates characteristics under six different operating pressures. The result was achieved by collecting and measuring water emitted through the pipe sections at pre-determined pressures. The various discharges, coefficient of variation, and pressure-discharge curves of the section of the pipe then determined from the data. The result shows somewhat similar trends on the increase for water collected with an increase in pressures; however, when statistically compared, the discharges among the pipe sections vary. The values of Coefficient of Variation (CV) are less than 10 % as the values CV range from 0.92 % to 5.82 %, which is within a good category, according to ASAE Standard EP405.1 of 0-10%. The findings indicate that, despite variations among the investigated sections, it can use any part as a representative unit in the soil column experiments with reasonable accuracy.

Keywords: porous pipe, coefficient of variation, discharge, short section, pressure.

62. CAFEi2020_164_175

Characterization of clay soil and zeolite powder as materials for the production of irrigation porous pipes

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Abstract

The uses of clay pipes in irrigation water management are becoming popular, especially in arid and semi-arid soils. The study examined clay and zeolite materials for irrigation pipes, and this paper reported characteristic properties of these materials. Hydrometer, pycnometer and core sampler methods were for soil physical properties determination. Consistency tests using (Atterberg method) and analytical techniques (Scanning Electron Microscopy, SEM and Energy Dispersive Spectroscopy, EDS) for samples analyses. The results indicate the soil to contain 11 % sand, 34 % silt and 55 % clay fractions and texturally classified as clay with a particle density of 1.58 g/cm³ and bulk density 2.43 g/cm³ respectively. Addition of zeolite at 3:1 clay/zeolite mix ratio shows liquid limit (LL) and plastic (PL) values to decreases from 50.7% to 43.7% and 27.6% to 27.3% while plasticity index, (PI) change from 23.2 to 16.7 respectively. The shrinkage rate decreases from 11.67% for raw clay to 8.92 % for the treated sample. The EDS analysis shows both clay and zeolite samples to contain carbon, silica (SiO₂) and alumina (Al₂O₃) as the major constituents with ferric oxide (Fe₂O₃), potassium oxide (K₂O) and cobalt (Co) as the minor constituents. The major constituents contribute 89.26 and 94.4% while minor contribute 10.74 and 5.59 % in clay and zeolite samples. Modifying clay improved its workability, reduces cracking potential and absorption capacity and performance of porous clay pipes.

Keywords: Clay, plasticity, irrigation, morphology, consistency test, chemical Composition

63. CAFEi2020_165_151

Evidence of potent antibacterial effect of fermented papaya leaf against opportunistic skin pathogenic microbes

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Abstract

The papaya leaf juice has been long practised as a traditional remedy to cure ailments due to its medicinal properties. The objective of this research is to study the effectiveness of fermented papaya leaf to inhibit the growth of opportunistic bacterial and yeast pathogens: *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Propionibacterium acnes* and *Candida albicans*. The efficacy of fermented papaya leaf against selected pathogenic microbes was evaluated using agar well diffusion assay, broth microdilution assay and time kill test. Evidence from data collected confirmed that fermented papaya leaf supernatant showed more pronounced antibacterial and antifungal effect than papaya leaf alone. Generally, fermented papaya leaf supernatant demonstrated potent antimicrobial effect against all bacterial pathogens tested particularly *P. aeruginosa* followed by *P. acne* and *S. aureus*. However, it was found that fermented papaya leaf was less effective against *Candida albicans*. It needs 4- to 7-folds higher concentration to inhibit 50% *C. albicans* growth than the bacteria. The antibacterial compounds produced in the supernatant appeared to have some bactericidal effect against *P. aeruginosa*, *P. acne* and *S. aureus* with the minimum inhibitory concentration (MIC_{>99}) of 16%, 50% and 60%, respectively. Particularly, the fermented papaya leaf supernatant at 60% concentration showed 100% inhibition rate within 30 mins against *P. aeruginosa*. However, it needs longer time to show the same inhibition effect against *S. aureus* and *P. acne*, which was about 2-6 h. The potent killing effect of fermented papaya leaf showed a potential use in skincare application to control pathogenic microbe infection

Keywords: Bacterial pathogens, Efficacy, Fermented papaya leaf, Minimum inhibitory concentration, Supernatant

64. CAFEi2020_168_153

Neural network controller for top tray temperature control of distillation column

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Abstract

The design and simulation work on neural network control of distillation column is presented in this paper. The multicomponent distillation column i.e depropaniser is used to separate propane from natural gas in gas processing plant. PID control is widely used to control the top tray temperature which consequently control the product composition. However, this control strategy is not effective for highly nonlinear and long time delay process such as distillation column. In this study, neural network controller is proposed to control the top tray temperature. The most significant variables that affecting the distillation column is identified and selected as the input to the controller. The simulation of the controller was carried out in the MATLAB environment. The training of neural network control was also conducted in MATLAB using Levenberg-Marquardt algorithm. The performance of the controller is compared with PID controller. The results show that neural network controller improves the top tray temperature control in term of set point tracking and disturbance rejection.

Keywords: Neural network controller, temperature control, distillation column, depropanizer

65. CAFEi2020_171_157

Adulterated stingless bee honey identification using NIR-spectroscopy technique

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Abstract

The objective of this study was to study the ability of the NIR spectroscopy (transmittance rate) to classify the pure and adulterated stingless bee honey across the wavelength range of 450nm – 969nm using an optical spectrometer. The physicochemical properties such as soluble solid content (SSC) and moisture content (refractive index, RI) of pure and adulterated honey has also been investigated using refractometer. Result shows that pure stingless be honey has highest transmittance rate, SSC and RI value compared to adulterated honey. There are significant differences ($P < .0001$) in the transmittance rate, SSC and RI of stingless bee honey over 5 different types of treatments . The result also shows that NIR data were good in classifying the samples into different treatments with 99.33% accuracy rate. As much as 34 wavelengths were found to be the most significant to discriminate the different treatments by PCA and LDA technique.

Keywords: stingless bee honey, adulterated, soluble solid content, moisture content, near-infrared.

66. CAFEi2020_175_165

A study of drying parameters on drying time and color quality of grated coconut using tumbling mechanism in convective dryer

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Abstract

A small scale convective dryer with tumbling mechanism was specially constructed for drying grated coconut. This new drying mechanism was evaluated in term of drying behavior and colour quality of the final product. It was found that the combination of (60 degree celsius, 6 RPM and 4.31 m/s) had the shortest drying time as well as the highest drying rate among other combinations. In contrast, combination factors of (50 degree celsius, 3 RPM and 2.06 m/s) had the lowest drying rate. Three main factors (temperature, rotational speed and air velocity) were significantly contributed to the response (drying time) as ($p < 0.05$). Drying rate also increased with increase in temperature, rotational speed and air velocity. In term of color analysis (L^* , a^* , b^*), there was a significant different among dried grated coconut samples. Nevertheless, sample (60°C, 3 RPM and 4.31 m/s) and (50°C, 3 RPM and 4.31 m/s) showed no significant different ($p > 0.05$) in lightness (L^*) when compared to fresh grated coconut hence excellent in retaining its original appearance. On top of that, sample (60°C, 3 RPM and 4.31 m/s) also achieved considerable drying rate with acceptable drying time (135 minute).

Keyword: Grated coconut, drying behaviour, cabinet dryer and color quality of grated coconut

67. CAFEi2020_176_174

Development of multiband optical sensing method for phenotyping of tomatoes in cultivation site

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Abstract

For development of a smart food chain, it is necessary to stably produce high-quality agricultural products in agricultural sector which is the starting point of the food system, and it is important to accumulate and analyse the phenotypic information of agricultural products during cultivation. An easy, rapid, non-destructive and quantitative evaluation method of tree vigor was then desirable. This study aimed to develop an X-ray fluorescent (XRF) spectroscopy of fresh leaves and infrared (IR) spectroscopy of fruit juice using a portable device. In addition, we studied the relationship between the spectroscopic information and the surface color of agricultural products, because the color has been practically and empirically used as one of the most important and useful quality indices in agricultural processes and the quantitative color evaluation method in under the natural lighting conditions has been developed using a commercial digital camera (Hashimoto et al., 2015, 2018). As the results, the changes in leaf element balances and organic matters in the fruits due to slight differences in cultivation conditions were grasped as the XRF and IR spectroscopic information. Furthermore, such changes could be reflected as the differences in the surface color information obtained using the digital camera. Therefore, it was experimentally suggested that the multiband optical sensing could be a powerful and important tool for realizing smart food chains and phenomics research starting from agricultural production.

Keywords: Color image analysis, Digital agriculture, Infrared spectroscopy, Phenomics, X-ray fluorescent spectroscopy

68. CAFEi2020_179_189

Comparison of edible pectin films made of different fruit purees on water solubility and mechanical properties

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Abstract

Recently, the development of pectin films has been extensively studied. Edible films function as a barrier for external packaging, and as a protection between the food and the surrounding environment. Due to the pectin's ability to display water soluble characteristics, it serves as a good matrix for the edible film. In this work, edible pectin film made of different fruit purees has been fabricated, and the aim was to produce water soluble and desirable mechanical strength of films for puree packaging. Thus, the research objective was to investigate the effect of different fruit purees in edible pectin films on their water solubility and mechanical properties. Fruit purees (4% on wt% basis) of dragon fruit, mango, papaya, and pineapple incorporated into pectin films and control pectin film were prepared using a solvent casting method. The water solubility test was conducted by determining the percentage solubility of films which immersed in water at room temperature for 24 hrs. Mechanical properties of films, including tensile strength, elongation at break, and elastic modulus were evaluated using a texture analyzer, with 50 mm initial grip separation and 0.5 mm/sec test speed. Among the pectin films, pectin film containing pineapple puree shows the highest tensile strength followed by pectin films containing papaya puree, mango puree, dragon fruit puree, and control film, as accordance to descending order. However, for elongation at break and elastic modulus, pectin film incorporated with mango puree presents the highest values followed by pectin film with papaya puree, pineapple puree, dragon fruit puree, and control film, descendingly. All edible films were completely water soluble.

Keywords: Pectin, edible, purees, solubility, mechanical.

69. CAFEi2020_180_167

Relationship of soil properties to the basal stem rot disease in oil palm plantation

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Abstract

Basal stem rot (BSR) disease is the most common manifestation of Ganoderma disease in the region. Losses begin to have a financial effect once the disease affects more than 10% of the stand. On average there is a decline of the yield of the fresh fruit bunch (FFB) of 0.16t/ha per year for every palm lost, and when the stand had declined by 50%, the average FFB yield reduction was 35%. The route of BSR colonization is unpredictable seems there is no tools or mechanism available in the market to identify the threat at the initial stage. This study was conducted to look at the relationship of BSR disease which may be significant to the soil properties. It was conducted at 3 different areas namely Jenderata Estate, Seberang Perak and Kluang. The soil series for both Jenderata and Seberang Perak was in Jawa series with the age of 9 years of oil palm tree. Meanwhile Kluang had Melaka soil series with the age of 25 years of oil palm tree. Soil sample were taken at all study areas with grid sampling method. Besides, incidence level of BSR disease both in healthy or infected tree was observed and recorded by MPOB expert team. Interpolation techniques were done for all data by using ArcMAP in order to identify the soil variability. The relationship of soil parameters and the BSR sampling data was analysed using statistical method in SPSS. Result showed that low magnesium was located in the infected area at Seberang Perak and Kluang although both areas had different soil series. Besides that, independent t-test at both study areas showed Mg had significance with BSR disease level. However, independent t-test showed only P had significant with BSR disease level in Seberang Perak and no significant in other area.

Keywords: Soil Properties, Basal Stem Rot, Nutrient Contents

70. CAFEi2020_181_230

Antioxidant activities, tyrosinase inhibition activity and bioactive compounds content of broken rice fermented with *Amylomyces rouxii*

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Abstract

Solid state fermentation (SSF) utilizing filamentous fungus *Amylomyces rouxii* was investigated as a bio-processing strategy to enhance the bioactive properties of broken rice. Fermentation was carried out for the duration of 18 days and samples were withdrawn at 2-days interval. Established methods were deployed to assess the changes in bioactive properties and compounds content in fermented broken rice. The bioactive properties studied were total phenolic content (TPC), total flavonoid content (TFC), DPPH-radical scavenging activity and ferric-reducing antioxidant power (FRAP). Additionally, tyrosinase inhibition activity, which represents anti-pigmentation / browning property, was evaluated. Free phenolic acids and organic acids content were determined through high performance liquid chromatography (HPLC). The results showed that fermentation significantly increased the total phenolic content of broken rice from 0.03 mg GAE/g sample to 3.94 mg GAE/g sample, and total flavonoid content from 0.04 to 1.71 mg QE/g sample. By the end of the fermentation, DPPH-radical scavenging of fermented broken rice was enhanced to 94.22%, compared to 9.03% in unfermented sample. It was also observed that FRAP and tyrosinase inhibition activity of fermented broken rice were improved up to 39-fold and 50-fold, respectively. Kojic acid, a potent antioxidant and tyrosinase inhibitor, was detected in fermented broken rice, along with oxalic and ascorbic acid. Gallic, protocatechuic and 4-hydroxybenzoic acids were enhanced upon fermentation. This study manifested the positive effect of broken rice after fermentation with *A. rouxii* and thus revealed the potential of fermented broken rice as a promising natural bio-ingredients in food, cosmetics and medicinal products.

Keywords: *Amylomyces rouxii*, antioxidant, bioactive compounds, broken rice, solid state fermentation

71. CAFEi2020_184_173

Macro and Micro-Nutrients of *Azolla pinnata* sp. as a soilless growth media

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Abstract

Azolla pinnata sp. is a small floating fern which widely occurs in certain regions such as Southeast Asia. *Azolla* is utilized in the new plant research on the currently existing products for soilless growth media. Soilless growth media are an alternative component to replace soil for cultivation uses. In urbanization scenario nowadays, most of the flatten open-area soil is used for development, affecting the soil supply for plants. To introduce a new component such as the soilless growth media, it must have the same or more nutrients than soil or other existing soilless growth media. A study found that *Azolla* is used as a soilless growth media in the nursery for olive trees cultivation. According to the study, the nutrients obtained from *Azolla* are sufficient to replace soil as a growth media. In this experiment, the Single Dry Ashing, and Kjeldahl and Dumas methods were used to evaluate and compare both macro and micronutrients of *Azolla* to Midorie Pafcal and Jiffy-7 pallets. Based on the results, the values were 0.94 % (N), 4352.00 ppm (P), and 563.13 ppm (K); compared to 1.35% (N), 377.13 ppm (P), 1512.33 ppm (K); and 0% (N), 563.13 ppm (P), 1343.67 ppm (K), respectively. The results also showed the values of Copper (Cu), Iron (Fe), and Zinc (Zn) for *Azolla*, Midorie Pafcal and Jiffy-7 samples were 15.33 ppm (Cu), 2579.67 ppm (Fe), 93.63 ppm (Zn); 7.53 ppm (Cu), 9988.33 ppm (Fe), 26.77 ppm (Zn); and 13.01 ppm (Cu), 1150.30 (Fe), 12.40 ppm (Zn), respectively. In conclusion, *Azolla pinnata* sp. is capable of providing the nutrients required for a plant, making it suitable as a soilless growth media for all plants.

Keywords: *Azolla pinnata* sp., soilless growth media, macro and micro-nutrients

72. CAFEi2020_188_180

Application of biomass residual oil in production of monoacylglycerol (MAG) through enzymatic glycerolysis using immobilized lipase

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Abstract

The empty fruit bunches (EFB) and palm oil mill effluent (POME) are the 2 major types of wastes generated in palm oil mills. Due to their massive amount, palm oil industries always encounter challenges for effective disposal. Therefore, this often results in severe environmental pollution such as oil spill to the land, spreading of diseases and water pollution that causes harm to the aquatic lives. In order to reduce these wastes, the present study aims to produce monoacylglycerol (MAG, a valuable emulsifier used in food industries) through enzymatic glycerolysis reaction of the residual oil recovered from EFB and POME. In this study, raw rice husks was firstly oxidized with sodium periodate. Then, it was functionalized with different combination of spacer arms (hexamethylenediamine, HMDA or ethylenediamine, EDA) and ligands (glutaraldehyde, GA or o-phthalaldehyde, OPA), respectively. Lipase from *Thermomyces lanuginosus* (40mg) was then immobilized on the rice husks surface. The results show that the highest protein loading (41.75%) was achieved by the immobilized lipase with HMDA and OPA being the spacer arm and ligand. In addition, the SEM and FTIR analysis also confirmed the presence of immobilized lipase on the rice husk surface. The prepared immobilized lipase will then be utilized in later experiments for MAG production by using the residual oil recovered from EFB and POME, through glycerolysis reaction. It is expected that the residual oils from EFB and POME will be valuable resources for MAG production and this will consequently contribute in achieving the target of transforming waste into wealth.

Keywords: Glycerolysis, immobilized lipase, monoacylglycerol, residual oil

73. CAFEi2020_189_176

A review of the in-field transporting machines currently used in oil palm plantations in Malaysia

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Abstract

This paper focuses on the in-field transporting machines currently used in oil palm plantations in Malaysia. It highlights the field conditions, the capacity of the machines and the time of completion of the transporting process which help to identify the determinants of the development of agricultural mechanization in Malaysian oil palm plantations. Understanding of the issues will help facilitate the elimination of weaknesses and defects prior to the manufacturing or modification stage. This will assist designers and manufacturers in the development and production of improved and more efficient field transportation equipment.

Keywords: Agricultural Mechanization, In-Field FFB Transporting Machines, Oil palm Mechanization.

74. CAFEi2020_189_208

Condition monitoring of TPU/UPM Fiat tractors using ICP&OES techniques

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Abstract

The use of agricultural tractors for various operations within a day calls for adoption of condition monitoring techniques in maintenance management strategies especially regarding engine lubricating oil change interval and predicting components replacement time before premature failure. Six Fiat tractors from TPU/UPM were monitored over three oil change intervals and oil samples taken for analysis using inductively coupled plasma & optical emission spectroscopy (ICP&OES). Twenty-three elements including wearing elements from engine, additive elements from oil manufacturers and contaminating elements from the environment were determined from 39 samples collected. Results indicated significant differences for 15 elements (Al, B, Ca, Cr, Cu, Pb, Mg, Mo, P, Ti, V, Zn, Si, K and Na) belonging to wear, additive and contaminating sources. This necessitated the use of condition monitoring for individual tractors instead of the general rule of preventive maintenance or even breakdown maintenance performed after the occurrence of failure.

Keywords: condition monitoring, fiat tractors, ICP&OES, Engine lubricating oil

75. CAFEi2020_190_177

Development of bio-pesticides against *Metisa plana* Walker bagworm (Lepidoptera: Psychidae) from bio-oil of oil palm biomass waste (palm kernel shell) as carrier

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Abstract

Despite the abundance of palm based residues generated, the by-products from thermochemical processing such as oil creates added value to the palm industry. The palm-based derived bio-oil contains highly aromatic compounds which is important as active ingredients in bio-pesticides formulation. Therefore, the objectives of this study are to investigate the formulation of the bio-pesticide from these bio-oil and to determine their effect toward insect-pest in oil palm such as *Metisa plana* bagworm. Prior formulation, preliminary evaluation on compatibility between bio-oil and surfactants such as tween 20 and tween 80 as bio-pesticides ingredient were evaluated using ternary phase diagram. The compatibility results showed the best formulation is at 20% of surfactant. Based on these conditions as basis, the experiment was formulated using active ingredient called azadirachtin which been extracted from neem seed. The formulated bio-pesticide was tested on bagworm for its effectiveness toward the mortality of the bagworm. The results successfully showed that the formulated bio-oil based bio-pesticide able to repel 50% of population of bagworm with lethal concentration (LC50) of 22.1 g/ml shows a good indicator as an effective repellent. Hence, this study provided a new knowledge for waste management towards zero waste strategy for better environment and sustainability.

Keywords: bagworm, bio-oil, bio-pesticide, neem extract, surfactant.

76. CAFEi2020_191_179

Lettuce classification using convolutional neural network

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Abstract

Determining the varieties of lettuce through image processing and pattern recognition is a part of precision farming. Automatic classification is becoming vital for precision farming practice as it is rapidly sprouting field with emergence of many applications in agriculture. It is a hassling process to differentiate and identify the lettuce varieties through human capabilities as it is time consuming and also prone to errors in the identification process. Hence, there is a need to perform this task assisted by a machine capability which makes it faster with even greater accuracy. The objective of this research work is to design an identification system with an accuracy of at least 90%. To achieve this, Convolutional Neural Network (CNN) was employed to classify seven types of most commonly found lettuce. The CNN model was trained with 7000 leaves and tested with 1800 leaves for the classification of 7 varieties of lettuce. The overall classification accuracy is 97.8%, meanwhile the individual classification accuracies for the selected lettuce varieties, i.e. Butterhead, Celtuce Love, Italian, Red Coral, Lactuca Sativa Lettuce, Red Oakleaf and Salad Grand Rapid are 97%, 99.3%, 98.7%, 96%, 100%, 99.3%, 94%, respectively. The results from this study has proven the high effectiveness of using a machine learning technique, i.e. CNN, to identify a particular variety of lettuce.

Keywords: Lettuce classification, machine learning, Convolutional Neural Network (CNN), precision agriculture, farming

77. CAFEi2020_192_181

Comparison of energy intensity of different food materials and their energy content

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Abstract

Energy embodied in different food materials refers to energy input in its production in agricultural and or livestock farms in direct or indirect forms. In this work it is intended to make a comparison among the energy intensity of cereals, cow milk and bull meat production. The study was performed for evaluation of the energy flow in dairy farms and related feedstuff production farms in northwest of Iran. According to the results, the energy intensity of wheat and corn is 4.35 and 9.19 MJ kg⁻¹, respectively, while they have the energy content of near 15 MJ kg⁻¹ as food materials with almost 15% moisture content. The energy intensity of ECM milk was calculated to be 5.81 MJ kg⁻¹, while it has the energy content of only 3.15 MJ kg⁻¹, with water content of 87.2%. About boneless meat, for a bull weight of up to 400 kg, the energy intensity was 75.4 MJ kg⁻¹ while it was 103.8 MJ kg⁻¹ for bulls up to 700 kg body weight. It is much higher than for milk and cereals, while, it has only 8.8 MJ kg⁻¹ energy content for fresh state with near 70% water content. Comparison of these energy values indicates the large effect of meat production on environment and reveals that the increasing demand for animal products in the future how dramatically will affect it. Therefore, replacing bull meat by sustainable food materials such as cereals and meat from not intensive kept animals could reduce pressures on environment.

Keywords: Cereals, energy content, energy intensity, meat, milk

78. CAFEi2020_192_183

Evaluation of different drying processes by energy consumption in a laboratory convection dryer

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Abstract

Drying is a process to increase the shelf-life of fruits by decreasing their water content. It is one of the energy consuming processes in food engineering. In many studies the drying time duration and quality of dried fruits have been investigated. In this study the energy consumption in different drying conditions was investigated for apple in a laboratory convection dryer. The drying conditions was application of the temperatures of 40, 50 and 60 °C and speeds of 0.5 and 1 m s⁻¹ for drying air under insulated and non-insulated drying chamber. Independent from drying duration, the highest energy consumption was recorded as 11.2 kWh for non-insulated dryer with the condition of 40 °C, 0.5 m s⁻¹. While, the lowest energy consumption was 5.8 kWh for insulated dryer with 40 and 50 °C with the same 0.5 m s⁻¹ drying air speed. The drying duration for these conditions was 537, 313 and 233 minutes. To achieve the shortest drying time (153 min), the condition of 60 °C and 1 m s⁻¹ in insulated dryer was used which caused the energy consumption of 7.2 kWh.

Keywords: Apple, drying, time duration, energy consumption, insulation

79. CAFEi2020_193_185

Effect of relative humidity and light exposure on fluorescence compound dynamics, soluble solid and acidity of iyokan during postharvest treatment

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Abstract

Miyauchi iyokan (iyokan) is harvested in late December to prevent winter injury. When harvested, the Soluble Solids (SS)/acid ratio is generally low; this ratio is the most commonly used indicator of juice quality. Thus, during postharvest treatment, the aim is to reduce the acid content, while improving SS. During postharvest treatment, environmental conditions, such as relative humidity (RH) and light exposure, can affect citrus quality, so the monitoring of the effects of RH and light is necessary. Thus, the objectives of this study are to observe the dynamics of internal quality, such as SS/acid ratio and fluorescence compounds, which are affected by RH and fluorescent light exposure, in order to investigate changes in citrus characteristics under different environmental conditions. The postharvest treatment involved storage at 5-10°C for two months under different conditions (dark and under light exposure) with high (80-90%) and low (40-50%) RH conditions. The SS/acid ratio did not change significantly over the two months of storage for any of the treatments, however, the high RH treatment had a slightly higher SS/acid ratio. Neither did the Tryptophan-like compound show any significant response in any of the treatments. In contrast, polymethoxylated flavones (PMFs) fluorescence intensity was higher in the dark compared to the light treatment. This compound possesses diverse signaling and defense roles in plants. In addition, significant increases in PMFs were observed after thirty days in storage as a response to light stress.

Keywords: fluorescence; polymethoxylated flavones; SS/acid ratio; relative humidity; light

80. CAFEi2020_196_190

Effect of pretreatment and fruits maturity on nutrient content of *Lepisanthes fruticosa* pulp/skin powder

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Abstract

The effect of pretreatment (steam and blanch) on nutrient content of *Lepisanthes fruticosa* was explored in order to develop a functional powdered ingredient from its pulp with skin (pulp/skin). Fruits maturity (unripe and ripe) were also explored for their nutritive and antioxidant potential upon ripening. The proximate composition and dietary fibre showed no significant difference between steaming and blanching samples. The maturity also shown no significant effect on the proximate and fibre contents. However, the vitamin C were significantly increased upon ripening, although both pretreatments showed no significant effect on the content. Total anthocyanins content (TAC) was significantly higher in control than that in steamed and blanched samples. Upon ripening, the values of TAC decreased in steamed sample, but increased when blanched. Antioxidant activity of *L. fruticosa* pulp/skin powder showed that the EC₅₀ was below 1 mg/ml and almost comparable with vitamin C and Trolox. Results of EC₅₀ also showed that samples prepared with blanching processed were the lowest compared to steaming and control samples but slightly increased upon ripening. It is suggested that blanching the pulp/skin of *L. fruticosa* before processed into powder could give better results to enhance its antioxidant properties. Results prove that pretreatment and maturity stages effect the nutrient contents of *L. fruticosa* pulp/skin powder.

Keywords: Pulp/skin, nutrient content, *Lepisanthes fruticosa*, antioxidant properties

81. CAFEi2020_197_204

Analysis of 3D image of oil palm tree to determine fresh fruit bunch (FFB) maturity features and position of the FFB in the frond spiral

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Abstract

Oil palm FFB need to be harvested at the right stage of ripeness to ensure optimum oil quality and quantity. A formula to estimate harvesting date oil palm FFB called “Maturity Model” is derived based on the information of rate of frond production per month (RFP), duration of oil palm FFB development from anthesis (DOFFB) and position of oil palm FFB in frond spiral (FFBPFS). Regression analysis between Maturity Model estimated harvesting time and actual in-field harvesting time gives the coefficient of determination $R^2 = 0.90$ and root mean square error (RMSE) of 1.58 weeks. A method to determine maturity based on frond position in the spiral was developed by using 3D image analysis of oil palm tree crown. Terrestrial LiDAR laser scanner (FARO Focus 3D 120) was used to acquire 3D point cloud data in order form a surface representation of oil palm tree. A Point Cloud Analyzation (PCLA) model was developed to analyze the characteristic of the oil palm tree. From the PCLA model, data of frond position in the spiral can be extracted. PCLA model gives 76% accuracy for identification of frond spiral arrangement and coefficient of determination (R^2) equal to 0.78 for identification total number of fronds. Labelling fronds number (frond position) in the spiral is done based on fronds height from the ground and then rectified using the Fibonacci angle. A non-linear decreasing fronds height plot indicates the presence of FFB in the frond spiral. The position of the FFB is then determined and used as input data in Maturity Model to calculate the FFB maturity stage. The outcome of this research can be further utilized for a fully automated process of FFB counting and FFB maturity stages determination. The FFB yield can be estimated and site-specific harvesting can be planned. Plantation manager can use this information to generate yield variability map and estimate the appropriate number of workers and machine required for plantation operation.

Keywords: FFB maturity, Bunch Counting, 3D Oil Palm Tree, Point Cloud

82. CAFEi2020_201_210

Proximate Composition of Malaysian Local Sweet Potatoes

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Abstract

The proximate analysis and total energy values of five local sweet potato varieties (Anggun 1, Anggun 2, Anggun 3, White and VitAto) were assessed through proximate analysis study. The proximate analysis was performed on three different parts of tuberous roots which are skin, cortex, and mixture of cambium and parenchyma. Results showed that White variety exhibited higher crude fiber content in all its three parts (11.18 % in skin, 2.92% in cortex and 9.99% in the mixture of cambium and parenchyma) while Anggun 3 has the highest energy values in all its three parts (117.04 kcal/100g in skin, 113.09 kcal/100g in cortex and 104.34 kcal/100g in the mixture of cambium and parenchyma). Besides, VitAto variety exhibited high starch content in all its parts as compared to other varieties (16.95 – 17.17%). These data suggesting that these sweet potato varieties have large potentials of biological properties and could have been found its application in wide industries such as food, beverages, chemicals, supplements and others. Furthermore, they could serve as a good energy source, considering their valuable nutritional properties.

Keywords: *Ipomoea batatas* L. Lam, sweet potato, proximate analysis

83. CAFEi2020_203_197

Shelf life and kinetic of changes in the quality parameters of fresh Malaysian sweet potato (*Ipomoea batatas*, cv. 'Anggun 1') during different storage temperatures

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Abstract

Storage temperature becomes an important factor in maintaining the quality and shelf life of sweet potato during storage. The objective of this study is to evaluate the effect of storage at different temperature conditions (10°C and 27°C) on whole sweet potatoes. The quality parameters of physico-chemical properties such as weight loss, shrinkage, colour, total phenolic, total flavonoid and anthocyanin content were investigated during the 7 weeks period. Sweet potato from a variety of Anggun 1 which is locally-produced in Malaysia was harvested at commercial maturity. Results revealed that during storage at 10°C, the changes in the physico-chemical properties of weight loss, shrinkage and colour were minimally affected. Total phenolic content is more affected by storage at 27°C with the losses of 18.78 mg GAE/g while total flavonoid content is similar for the both storage temperatures. The less significant changes ($p < 0.05$) of anthocyanin content was showed during storage at 10°C by 1.31 mg/g. A zero-model fitted well the experimental data on weight loss and shrinkage. The storage temperature effect was successfully described by showing that the shelf life of Anggun 1 is longer during storage at 10°C of 2.25 weeks. These results indicated that the best storage is 10°C for sweet potato is preferable and could prolong the quality.

Keywords: Storage temperature, quality, sweet potato, physicochemical properties

84. CAFEi2020_205_199

Analytical comparison between the speed of screw and crank-rocker based pick and place mechanisms for seedling tray seeding machine

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Abstract

In this study the operational speed of screw based pick and place mechanism was compared with that of a crank-rocker based pick and place mechanism analytically for the design of a seeding machine for system of rice intensification (SRI) seedling tray. The configurations of the two types of mechanisms were generated based on their positions relative to a seedling tray conveyor and size of seeding manifold. The screw based mechanism consists of a vertical screw to which the seeding manifold was mounted and a horizontal screw to which the vertical mechanism was mounted. The vertical screw bearing the seeding manifold reciprocates down to pick seeds from seed container and back to the initial position. The horizontal screw translates horizontally to deliver the vertical screw bearing the seeding manifold to the seedling tray on the conveyor. The crank-rocker based mechanism consists of a pair of crank-rocker carrying a seeding manifold in between them. The mechanism rotates clock wise to pick seed and counter clock wise to drop the seed on the seedling tray. The time required for a complete pick and place circle was computed for both mechanisms using basic mechanics principles. Crank-rocker mechanism with a theoretical pick and place period of 1 second was found to be better than the screw based mechanism with 78.8 second per pick and place circle.

Keywords: Seedling tray seeding, screw mechanism, crack rocker mechanism, speed of operation.

85. CAFEi2020_208_202

Effect of essential oil nanoemulsion coatings on guava fruit

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Abstract

Nanoemulsions possess powerful nano-scale particles that make them attractive for diverse applications. In this study, clove oil and lemon oil nanoemulsions were prepared using virgin coconut oil as the carrier oil via high pressure homogenizer. The nano-emulsion was then characterized and then incorporated with chitosan to produce edible coating. The coatings were applied onto guavas by dipping the fruits into the nanoemulsion solutions for 3 minutes and air-dried. The effect of nanoemulsion coatings was compared to essential oil/chitosan and chitosan only coatings. The results obtained indicated that nanoemulsion coatings are significantly more effective in reducing the total plate count and yeast and mold counts compared to the other treatments. Nanoemulsion coatings also reduces the weight loss and yellowness of guava and preserve the firmness of the guava during 10 days storage at room temperature.

Keywords: nanoemulsion, coating

86. CAFEi2020_213_205

Determination of tensile properties for twisted fibre bundles of oil palm empty fruit bunch at different diameters

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Abstract

The potential use of natural fibre extracted from oil palm empty fruit bunches has gained wide attention among researchers. This natural fibre comes from fibrous strands which form fibre bundle after shredding process at a mill. The measurement of tensile properties is important to understand the mechanical performance of this fibre bundle. This study was undertaken to determine the tensile properties of the fibre bundle from oil palm empty fruit bunch (OPEFB). Fibrous strands of the OPEFB extracted from shredded empty fruit bunches were twisted to form fibre bundle specimens at different diameters varying from 1 to 5 mm. The tensile properties measured in this study including tensile strength, tensile load and tensile modulus. The measurements were performed using Instron Universal Test Machine (IUTM) model 5000. From the results, it was found that the specimens at 1 and 5 mm in diameter required 71.25 and 429.68 N of the tensile load to break, respectively. The specimen with 1 mm in diameter recorded the highest tensile strength of 90.72 MPa while the specimen with 5 mm in diameter recorded only 21.88 MPa. The highest tensile modulus with value of 662.50 MPa was obtained from the specimen with 1 mm in diameter while the specimen with 5 mm in diameter had the tensile modulus value of 157.47 MPa. It was also found that the tensile strength and tensile modulus decreased when the diameter of the specimens increased. The findings reported in this study can serve as an engineering basis for the design specification in the development of the future in-silo composting machine.

Keywords: tensile properties, oil palm, fibre, empty fruit bunch, diameter.

87. CAFEi2020_215_215

Mass modeling of pepper berries (*Piper nigrum* L.) with some physical properties

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Abstract

The determination of correlations between mass with its physical properties such as dimensions, volume and projected area is crucial in design and development of some post-harvest processing. In this study, the physical properties were measured and the mass of Kuching pepper berries variety was predicted in four models including Linear, Quadratic, S-curve and Power. Thus, the study was aimed to determine the most applicable model for predicting pepper berry mass with their physical properties and determine some physical properties of pepper berries to form an essential and useful information. The results showed that mass modeling based on actual volume of pepper berries was more applicable compared to other properties with the highest determination coefficient, 0.995 at 1% probability level. From the economic standpoint, predicting mass based on actual volume as Quadratic form: $M = 0.828 - 0.015X + 7.376 \times 10^{-5}X^2$ is recommended.

Keywords: Pepper; Mass modeling; Physical properties; Prediction

88. CAFEi2020_220_220

Development of an applicator for treatment of oil palm tree due to *Ganoderma Boninense*

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Abstract

Disease on oil palm trees cause by *G. boninense* may lead to rotting and eventual death to the trees. This constitute loses in terms of financial and productivity. Currently, one of the methods in treating the disease is through injection of solution that consists of hexaconazol or tetraconazol as the active ingredients. While the type of effective solution may have been identified, the application technique can be simplified much further. At the moment, once the effected tree has been recognized, the next step is to drill the tree and then the driller is taken out and an injector is put forward. This paper presents the study and analysis of penetration forces by drilling and fungicide-liquid flow behavior by injecting on the oil palm trees. A test rig platform was designed for the study drill force. It was found that the resistance was within 20 N. The results will influence the direction of a new mechanism design to implement the solution.

Keywords: *Ganoderma boninense*, disease, oil palm trees

89. CAFEi2020_221_218

From farm to fork: Cultivation, postharvest and processing of strawberry in Japan

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Abstract

Strawberry cultivated in Japan widely known for its sweet and soft nature which regards as premium fruits in Japan. The objective of present study is to give an overview of strawberry cultivation, and postharvest processing in selected manufacturers and farms in Nagano, and Hokkaido, Japan. The information was obtained through interview session, and questionnaire distribution. The obtained data reported using case study approach. The cultivation of strawberries in Japan at selected study area mainly planted in greenhouse under controlled temperature to maintain the quality and yield of strawberries. The strawberries in all the selected farm mainly used manual grading process during strawberry picking process. Processing of strawberries into other products often done in small-scale by the farmers and sold directly in the farm and distribute to other local seller and supermarket which portray “from farm to fork” practice. Strawberries processed into products such as jam, drinks and ingredients in bakery goods labeled as premium in Japan which often sold in specialty shop. Strawberries and strawberry-based products of Japan produced by larger manufacturer managed to penetrate Hong Kong, Malaysia and Thailand market.

Keywords: strawberry, processing, cultivation, Japan, case study

90. CAFEi2020_222_219

Modeling respiration rate of fresh cut sweet potato (*anggun*) stored in different packaging films

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Abstract

This study is to model the respiration rate and to determine the quality attributes including color, fresh weight, and texture of fresh-cut *Anggun* stored in different packaging films and storage conditions. Fresh-cut *Anggun* was packed in three different packaging films; nylon (OTR: 55 cc/m²/day, WTR: 334 g/m²/day), polyethylene terephthalate, PET (OTR: 90 cc/m²/day, WTR: 35 g/m²/day), and low-density polyethylene, LDPE (OTR: 8000 cc/m²/day, WTR: 200 g/m²/day) and stored at 5 °C and 30 °C. Regardless of film used in this study, fresh-cut *Anggun* was found to have shelf life up to 14 days when stored in 5 °C and up to 8 days when stored in 30 °C. In both temperatures, nylon showed the best performance compared to PET and LDPE. It was able to retain the purplish color longer, least fresh weight loss, and has lowest respiration rate. Uncompetitive Michaelis-Menten model was proven to show good agreement with experimental data on respiration rate of fresh-cut *Anggun*.

Keywords: Sweet potato, *Anggun*, fresh-cut, quality and shelf life, respiration rate, modeling, Michaelis-Menten

91. CAFEi2020_223_224

Comparison of field performances between two typical mini combine harvesters in grain corn production

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Abstract

A mini combine harvester was efficiently designed and developed to harvest grain corn on a small scale farm in order to reduce manpower and operating time as delayed harvesting leads to grain loss. Two typical mini combine harvesters namely Kubota DC105X (*KDC*) and World Star 7.0Plus (*WS*) have been introduced to farmers as high output, low fuel consumption and ease of maintenance in grain corn production. This research was undertaken to evaluate and compare the field performance of *KDC* and *WS* mini combine harvester which included the field efficiency (FE), effective field capacity (EFC), fuel consumption (FC), field machine index (FMI) and total field time under similar field condition and soil properties. A time-motion study was conducted during harvesting in two consecutive growing seasons. The mean values of EFC, FE, FC, FMI and total field time for *KDC* were found to be 0.28 ha/hr, 50.00%, 16.85 l/ha, 0.84 and 3.55 hr/ha, respectively. The mean values of EFC, FE, FC, FMI and total field time for *WS* were found to be 0.25 ha/hr, 54.35%, 12.57 l/ha, 0.81 and 3.99 hr/ha, respectively. The statistical analysis (ANOVA) shows that there were no significant differences in field performance between both mini combine harvesters at 5% significance level ($\alpha = 0.05$). Both mini combine harvesters had performed with consistent and reliable results in conducting the harvesting. This study concludes that the *WS* is more efficient than *KDC* in terms of FE and FC.

Keywords: corn, efficiency, grain, harvesting, mechanization, performance

92. CAFEi2020_224_225

Revamp of existing lab-scale electrolytic cell design for electrolyzed water study in cleaning application

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Abstract

The lab-scale electrolytic cell was designed to produce acidic and alkaline electrolyzed water for cleaning study. Electrolyzed water (EW) was produced by electrolysis of a dilute sodium chloride solution. The generation of free chlorine, pH and oxidation reduction potential from the electrolysis process by the electrolytic cell were far from the expected value. Thus, the lab-scale electrolytic cell was revamped by using acrylic slot to hold the electrode plate and a membrane holder without metal screws. This revamp work is to reduce the resistance for current flow with the aim to increase the value of chemical properties (pH, oxidation-reduction potential, free chlorine) for acidic and alkaline electrolyzed water. Findings have shown that the current was increased from 0.0013A to 2.5A after the revamp process. As a result of the revamp, the value of pH, oxidation reduction potential and free chlorine for acidic electrolyzed water was increased by 1.7 times, 2.7 times, and 20 times higher than previous results respectively. While for alkaline electrolyzed water, the value of pH and oxidation reduction potential was increased by 1.4 times and 6.2 times higher than previous results respectively.

Keywords: Electrolysis, Green cleaner, Corrosion, Cleaning, Food industries

93. CAFEi2020_226_227

Conceptual design of portable electrolyzed water cleaning rig using Triz method

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Abstract

In this study, theory of inventive problem solving (TRIZ method) is applied in the development of portable electrolyzed water cleaning rig. A new conceptual design for the rig, which is robust and affordable is proposed. The rig could improve cleaning efficiency significantly in SME food industry in Malaysia, which is a major cause of low number of SME with GMP certification. However, the final conceptual design has to undergo several modifications for assembly and manufacturing purposes, which will be performed in a further study. The idea of generation for the portable electrolyzed water cleaning rig design was illustrated based on the TRIZ contradiction matrix.

Keywords: Electrolyzed Water, Green Cleaner, Water Jet, Biodegradable, Sustainable Technology

94. CAFEi2020_231_229

Assessment of evaporative cooling system potential for short-term storage management of vegetables during transportation

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Abstract

A system based on direct evaporative cooling principle for short-term storage management of vegetables during transportation was designed, developed and assessed its performance. The evaporative cooling applies the principle of water evaporation to achieve temperature reduction and relative humidity increment. The system comprises evaporative cooler, power supply (battery, battery charger and power inverter), control panel, storage unit and real-time data monitoring (of temperature, T and relative humidity, RH). The evaporative cooler consist water reservoir, pump, cooling pad, extraction fan, connecting pipe and control panel. The system (that applies alternating current (AC)) can be powered by two-12 V serial truck batteries (direct current, DC) via power inverter. In this research, the effect of water type towards cooling process inside storage unit was studied too. The use of icy water as an evaporation media exhibited higher temperature reduction, ΔT (6.11 ± 2.30 °C) as compared to ambient water (4.06 ± 1.91 °C). RH for both cases achieved 99 %. The quality of selected leafy vegetables (green amaranth, water spinach and choysum) for fresh market that underwent evaporative cooling storage treatment (T1) was assessed. Post four-hour storage, leafy vegetables stored under T1 exhibited the least weight loss as compared to ambient storage treatment (T2) and cold storage treatment (T3). However, post two-week storage, the vegetables quality that underwent T1 was comparable to T2, but slightly lower than T3. The system exhibited potential to maintain vegetables quality during the short-term storage in transportation.

Keywords: Direct evaporative cooling, leafy vegetables quality, short-term storage, transportation.

95. CAFEi2020_236_233

Effect of high-pressure processing (HPP) on composition, lactose and microstructure of goat milk

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Abstract

High pressure processing (HPP) is an alternative method for thermal pasteurization of liquid food such as milk. Employing pressure could potentially affect the composition and microstructure of milk and milk products. Therefore, this study focus on evaluating the effect of high pressure processing (HPP) towards the composition, lactose content and microstructure (in term of fat globules) of goat milk. The goat milk was subjected to HPP at a pressure range of 200 to 600 MPa and process holding time at 5 - 15 minutes. There were insignificant differences in terms of fat, protein and carbohydrate but significant changes were observed for lactose content of pressurized goat milk (PGM). The lactose content of PGM was in the range of (2.540 – 2.986 g/ml), while 1.253 ± 0.01 g/100 ml for untreated goat milk (UGM). In terms of microstructure, the highest pressure (600 MPa) with a holding time 5 - 15 minutes, a higher number of the small size of goat milk fat globule was observed as compared to lower processing pressure (200 and 400 MPa). The mean diameters of fat globules were in the range of 5.215 to 5.651 μm . This size reduction of milk fat globules is an advantage for cheese making or other dairy product making industries, cause it can help to possess smoother and finer texture of milk products.

Keywords: fat globule, goat milk, high pressure processing, lactose, microstructure

96. CAFEi2020_243_237

Flower bagging effects on the α -mangostin content during mangosteen fruit growth

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Abstract

Mangosteen fruit (*Garcinia mangostana* L.) is consumed mainly for two purposes, i.e. its aril for fresh or minimally processed products and its rind for herb and other health-related products. In facts, due to high portion of rind compared to its whole fruit, its rind has a more important economical value, especially for its α -mangostin content. This study reported the effects of flower baggings on the α -mangostin content during mangosteen fruit growth. This field research was conducted in a farmer's field at Gisting village, Tanggamus district, Lampung Province, Indonesia. The study was arranged in a 2 × 3 factorial design. The first factor was bagging date [2 and 4 weeks after anthesis (WAA)], and the second one was bagging material (unbagged or control, banana 'Cavendish'- paper bag, and balloon). Fruit samplings were conducted in every two weeks during the periods of 8-16 WAA. . The α -mangostin content was analyzed with HPLC [Dionex-UltiMate® 3000, autosampler, column compartment, Ultimate 3000 pump, UV detector, column Enduro C-18 (250 mm × 4.6 mm, 5 μ m) with C18 guard]. The results showed that the α -mangostin content was increased in a sigmoid pattern during fruit growth, and the increase was mostly not affected by bagging, bagging materials, and application periods. The α -mangostin content was increased tremendously during 10-14 WAA, regardless of bagging, bagging materials and application periods. Bagging slightly decreased α -mangostin content during the latest period of fruit growth, regardless of bagging materials and application periods.

Keywords: α -mangostin, bagging, fruit growth, mangosteen, preharvest

97. CAFEi2020_248_238

Cottage cheese products fortified by natural antioxidants

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Abstract

Currently, in the modern urbanization terms and restrictions in the correct nutrition, a great value for a human metabolism have available fermented dairy products, as for instance, cottage cheese that is a fermented milk product produced by using starter microorganisms. Moreover, the enrichment of the functional specificity of such products by ingredients which consist in vitamins C, E, A, D, K, macro- and microelements is a very advanced direction for the research. Particularly, for the fortification of the cottage cheese products by antioxidant properties, the extracts of the following plants were used: ginger, topinambour and radish. These vegetables contain the following antioxidants: retinol (vitamin A), thiamine (B1), folacin (B9), riboflavin (vitamin B2), tocopherol (vitamin E), ascorbic acid (vitamin C) et al. Organoleptic characteristics, sensory assessment and physicochemical properties confirm that the developed compositions satisfy to the standard requirements for a cottage cheese. Particularly, the samples had a milky-white color, a pleasant uniform consistency with additives particles, without outside smells and a moderately taste of ginger, topinambour and radish. The content of mineral substances in the cottage cheese products was determined by the method of Mass-spectrometry with inductively coupled plasma (ICP-MS) and using a Scanning Electron Microscope (SEM). The presented samples have high nutritional values and important macro- and microelements: potassium, calcium, magnesium, phosphorus, sodium et al.

Keywords: antioxidants, cottage cheese, ginger, topinambour, radish, vitamins

98. CAFEi2020_248_247

Enriched plum filling for the confectionery

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Abstract

Plum is available in the receipts of various confectioneries: sweets, caramels, creams, jellies, cookies and others. The useful nutritional value of plum is related to the most quantity of vitamins like: Vitamin A - beta carotene, Thiamin (B1), Riboflavin (B2), Niacin (B3), Pantothenic acid (B5), Vitamin B6, Folate (B9), Vitamin C, Vitamin E, Vitamin K; and minerals: Ca, Fe, Mg, Mn, Ph, K, Na and other. Vitamins C, E and beta carotene (a form of vitamin A), as well the flavonoids' representative subclass anthocyanidins are presented in plum. Organoleptic characteristics and physicochemical indicators of the developed compositions fully satisfy to the standard requirements for a confectionery filling. By sensory assessment in accordance with the «Just-About-Right-Test», it was identified that composition of plum filling with gelatin and lemon is most preferable. The content of mineral substances in the confectionery filling was determined by the method of Mass-spectrometry with inductively coupled plasma (ICP-MS) and using a Scanning Electron Microscope (SEM). The presented samples have high nutritional values and important macro- and microelements: sodium, magnesium, phosphorus, potassium, calcium, iron et al. Proposed plum filling has wide range applications, as inside and outside for the covering of confectionery, thereby organoleptic properties and nutritional value of final product could be enriched.

Keywords: antioxidants, confectionery, filling, plum, vitamins

99. CAFEi2020_249_239

Challenges of IoT/5G advancement in the oil palm upstream

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Abstract

5G technology is vital for the development of Internet of Things (IoT) application in Malaysia to enhance the development of the agriculture and plantation industry. The nation is marching towards big data and artificial intelligence. Consequently, having 5G networks merging with IoT technology as a platform would contribute to the country's gross domestic income up to RM 12.7 billion ringgit. There are tangible and intangible benefits to the oil palm industry if the technologies of 5G/IOT are implemented. In the oil palm industry, the technology of 5G network can uplift the current technology in the field to enhance the labour productivity. On the other hand, the dependency on foreign workers can also be reduced. Apart from that, the use of 5G/IoT will improve crop productivity and land use efficiency to improve palm oil yield. However, IoT platforms implementations on 5G technology will be challenging in rural oil palm areas where there is low signal for communication. In relation to that, preliminary research shows that LoRA technology is able to work in remote areas. IoT/5G technology implementation is vital in the oil palm plantation at the upstream level.

Keywords: oil palm technology, economic influence, labour management, 5G/IoT

100. CAFEi2020_253_242

Shelf life extension of Saba banana: Effect of vacuum packaging and storage temperature

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Abstract

The shelf life of banana is very much dependent on the packaging method and storage temperature. Ordinary food packaging method traps air with the food product. Oxygen and moisture in the air cause the banana to degrade over time, lose flavor and nutrition as well as shorten the shelf life. Vacuum packaging is an effective solution that can be used to remove air in food package thus inhibit the growth of bacteria, mold, and yeast that contribute to food spoilage. Thus, this work is directed to investigate the effect of vacuum packaging and storage temperature on extending the shelf life of Saba banana. Peeled and unpeeled; and vacuum packed and non-vacuum packed banana was kept at different storage temperatures (25, 9, and -20°C) for 28 days. The shelf life of banana was investigated in terms of physical properties such as texture, color changes, and moisture content as well as in terms of microbial activity. Based on the physical properties analysis, vacuum packaging and low storage temperature were found to significantly delay the ripening process of banana whereby less reduction in fruit firmness, color changes, and moisture content loss was determined for vacuum-packed banana stored at low temperature. The microbial analysis also revealed that vacuum-packed banana exhibited fewer colonies forming units than non-vacuum-packed banana. In conclusion, vacuum packaging and low storage temperature are able to extend the shelf life of banana.

Keywords: Banana, Microbial activity, Saba, Shelf life, Temperature, Vacuum packaging

101. CAFEi2020_255_244

Effects of extraction conditions on characterization of gelatin from buffalo (*Bubalus bubalis*) skin

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Abstract

The aims of this study were to determine the characteristics of gelatin from buffalo (*Bubalus bubalis*) skin pre-treated with NaOH and Ca(OH)₂ at different concentration (0.3 M, 0.5, and 0.7M) and extracted at 65 °C for 6 h and 24 h, respectively. The gelatin obtained was evaluated for its moisture, protein and ash content, UV-vis absorption value, color, emulsifying and foaming properties. The highest yield (20.25 %) was observed for gelatin extracted by 0.5 M NaOH at 24 h extraction time. For alkaline pre-treatment it was found that NaOH was more efficient than Ca(OH)₂ in preparing the skin for subsequent extraction process. Protein content of the extracted gelatin samples were in the range of 71.76 % - 87.83 %, showing that the varying processing conditions are adequate enough to recover protein from the raw material. Ash content for all samples were in agreement with USDA standard, which were below than 3 %. The extracted gelatin had varying pH values which were from 5.47 to 7.02. The gelatin were basically colourless with 'L' values of more than 80, except for 0.7 M Ca(OH)₂ at 24 h which showed slightly darker properties. The intensity of the UV-vis absorption spectrum showed that a high absorption peak was seen at 6h of extraction time (230 – 250nm) compared to 24 h extraction time. Emulsifying properties of buffalo gelatin increased with increasing concentrations of alkaline except for 0.7 M NaOH and 0.7 M Ca(OH)₂ for both extraction time. Meanwhile foam expansion of the gelatin extracted from the different extraction conditions were observed to have significant difference ($p < 0.05$) for all samples. In conclusion buffalo skin has the potential to be an alternative source of gelatin in diversified industrial application by modifying the extraction conditions in order to produce gelatin with desired quality.

Keywords: Gelatin, buffalo skin, extraction condition

102. CAFEi2020_256_243

Characterisation of Gelatin extracted from Buffalo (*Bubalus bubalis*) Bone using Papain Pre-treatment

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Abstract

This study was carried out to extract gelatin from the bone of Buffalo (*Bubalus bubalis*) by incorporating enzymatic pre-treatment. Papain-aided extraction (PE) (9.1 ppm of papain at 50 °C water) was employed in the pre-treatment step, in which non-enzymatic extraction (NE) was carried out for comparison. The gelatin obtained were next evaluated for their physicochemical properties such as moisture, protein, and ash content, colour, and UV-vis absorption. Functional properties of the gelatin which included emulsifying and foaming properties were also determined in which four-fold increments in yield (wet basis) were obtained for PE (29.92 %) as compared to NE (7.5 %). Moreover, no significance difference ($p > 0.05$) in moisture content was observed for both PE and NE, although the protein content of the gelatin was observed in the range between 70-90%. The resulting gelatin from both extractions was generally yellowish in appearance and was confirmed by the colourimetry data where no significant difference ($p > 0.05$) was observed for both samples. The maximum absorption peak for both PE and NE was observed at 210 nm, which was in the range commonly reported for gelatin. In addition, the emulsifying and foaming capacity of PE and NE had no significant difference ($p > 0.05$), although emulsion stability for PE was shown to be significantly higher ($p < 0.05$) compared to NE. The present study was an attempt to evaluate the potential use of local buffalo bone as raw material for gelatin production, which found that extractability could be improved with enzymatic pre-treatment in obtaining acceptable gelatin qualities.

Keywords: Buffalo bone, gelatin, papain-aided extraction, non-enzymatic extraction.

103. CAFEi2020_257_250

Anti-inflammatory activity of raw and thermosonicated stingless bee honey

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Abstract

The anti-inflammatory activity of raw and processed *Kelulut* stingless bee honey was investigated for its ability to inhibit nitric oxide (NO) production in lipopolysaccharide-stimulated RAW 264.7 cells. Raw honey was optimally processed by thermal processing and thermosonication at 90°C. The 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-tetrazolium bromide (MTT) cell viability assay showed that *Kelulut* honey from 7.8 to 500 µg/ml was not cytotoxic to RAW 264.7 cells as it resulted in at least 80% viable cells after 24 hr. Both raw and processed honey from 10 to 300 µg/ml displayed increase and decrease in NO concentrations, suggesting a mixed effect of NO inhibition and enhancement. Maximum NO inhibition of 17.5% was recorded from 20 µg/ml of thermally processed honey while the highest NO enhancement of 7.8% was from 10 µg/ml of thermosonicated honey. The NO effects were independent of honey concentration and processing techniques, suggesting its potential robustness in medicinal properties as part of diet.

Keywords: nitric oxide, RAW 264.7, stingless bee honey, thermal processing, thermosonication

104. CAFEi2020_261_248

Evaluation of fertilizer electrical conductivity (EC) and temperature distribution via vertical farming system under plant factory

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Abstract

A plant factory has been developed at Horticultural Research Centre, MARDI Serdang. The cultivation approach under the plant factory consists of nine units planting racks with each rack having seven tiers or levels that can cultivate up to 900 crops per rack. Each unit of planting racks has been installed with electrical conductivity (EC) and pH monitoring system. EC is a meaningful indicator of water quality, soil salinity and fertilizer concentration. In this study, the data for EC and temperature were taken for each level different locations (three points along the rack) to evaluate the fertilizer quality distribution. The objective of the study was to evaluate the effectiveness of EC and temperature distribution on the planting rack of vertical farming system under the plant factory. From the study, it was found that EC and temperature parameters were not significantly different at each level and the point location of the vertical farming system. EC and temperature parameters were significantly different with the time (week) and point location from week to week. The effect of the interaction between time (week) and level on EC and temperature parameters were not statistically different. Therefore, it can be concluded that the effect of EC and temperature distribution at different levels of the vertical farming system did not depend on the time.

Keywords: Plant factory, vertical farming system, fertilizer concentration distribution, Electrical Conductivity and temperature monitoring.

105. CAFEi2020_262_251

Behavior of agricultural drone during spraying and its potential effects on quality and quantity of applied pesticides

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Abstract

As the main spraying objective is always to make sure that the sprayed pesticides reached and distributed uniformly on the spray target, the sprayed chemicals by agricultural drone has been reported to be scattered and not distributed evenly. In order to reach an effective spraying, it is important for the ground pilot to understand on how to achieve quantity and quality in the field spraying operation. This research focused on analyzing the behavior of the drone that potentially leads to the non-uniformity of the distribution. The objectives are to determine the blade respond towards speed and payload, time and distance at different phase of speeding and effective travelling time. For this purpose, a hexacopter Advansia A1 was used in a test flight on an area of 1000 m² in 6 flying paths of 56 m length each. The drone was set to test at a combination of 5 payloads (10, 8, 6, 4, and 2 kg) and 4 average flying speed (i.e 1, 3, 5, and 7 m/s). After each flying operation, the recorded flight data was extracted from the flight controller of the drone using the interfacing software SuperX. From the result, the RPM of the blade respond significantly towards drone speeds and payload. It has been found that, the higher the speed is set, the less time and distance for the drone to stable at the desired speed due to it lengthiest time taken in building up and slow down the speed. Due to this behavior, the average actual speed of drone was 0.963, 2.723, 3.831 and 4.045 m/s, which is lesser from 1, 3, 5 and 7 m/s speed set respectively. Reflected to the pesticide application, the variation of RPM with the reduction of the payload during spraying, different phases of speeding and drone actual travelling speed would obviously affect the distribution quality and quantity of the applied pesticide respectively. This information is important for the users in making the decision for effective spraying operation.

Keywords: Aerial spraying, agricultural drone, flying behavior, spraying management

106. CAFEi2020_263_253

Shelf life of encapsulated bioactive compounds extracted from jasmine flower using electrospray method.

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Abstract

A novel non-thermal encapsulation technique of bioactive compounds extracted from Jasmine flower was demonstrated using an electrostatic atomizer or electrospray in the ambient condition. In this study, the extracted bioactive compounds were encapsulated with β -Cyclodextrin (β -CD) due to their ability to form an inclusion complex with the guest compounds. To evaluate the encapsulation process and its efficiency, the atomized encapsulated compounds were compared with the non-encapsulated compounds using the field emission scanning microscopy (FE-SEM), thermogravimetric (TG) analysis, and Fourier transform infrared (FTIR). From the FE-SEM images, the atomized droplet was transformed into a solid crystal sphere while the non-encapsulated one was indicated with the uncertain shape form. The inclusion complex of bioactive compounds was verified by the identical spectrum between encapsulated compounds and β -CD sample. The loss of two peaks which at 2357 and 1030 cm^{-1} at week 4 confirmed the degradation of non-encapsulated compounds when exposed to the environment. By using TG analysis, it was found that the degradation of bioactive compounds in encapsulated sample was shifted from 75 - 140 °C to 110 – 260 °C which indicated the thermostability of compounds after the encapsulation.

Keywords: Non-thermal encapsulation, Electrospray, β -Cyclodextrin, Bioactive compounds, Shelf life.

107. CAFEi2020_265_252

CFD simulation of temperature and airflow inside a shipping container size plant factory for optimal lettuce production

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Abstract

Computational fluid dynamics (CFD) have been playing an increasingly important role in designing the agriculture control environment structure in the past few years. Plant factory is a fully enclosed control environment agriculture structure developed to create optimum growing conditions for the crops. Previous studies have proven that CFD technique was able to analyse and predict the internal climate of the plant factory in the designing stage before the actual plant was built. This study was conducted to analyse the changes in air flow characteristics and temperature distribution in a shipping container size plant factory with different inlet and outlet locations. Uniformity of air flow and temperature distribution was important in plant factories as it is responsible to create optimum and uniform growing conditions for crops. The CFD model was validated by comparing simulation and experimental data of existing plant factory inlet and outlet location. The validation result shows an acceptable percentage error between simulated and measured data. Two alternative designs of the inlet and outlet location were simulated to improve the uniformity of air flow and temperature distribution. The validated CFD model was then used to simulate the alternative design. Finally, the location of inlet and outlet that produce the most uniform air flow and temperature distribution inside the plant factory was identified.

Keywords: CFD simulation, plant factory, air flow distribution, temperature distribution

108. CAFEi2020_268_254

Effect of different glycerin percentages on mechanical properties and seal strength of pectin film

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Abstract

In recent years, the development of biopolymer packaging materials from pectin has received increasing attention for the production of flexible packages. The mechanical properties and seal strength of films are among the important criteria for the evaluation of package integrity. The package itself must have sufficient strength to hold the food in the package. Thus, the research objective of this work was to investigate the effect of different percentages of glycerin on the mechanical properties and seal strength of the pectin films. The pectin films were produced using a solvent casting method by mixing an aqueous dispersion (4% w/w) of food-grade pectin with different percentage of food-grade glycerin (10 – 50% wt/wt, pectin basis) and beeswax at a fixed concentration of 20% (wt/wt, pectin basis). Heat sealing was performed using an impulse heat sealer at different levels of heat (Level 1 – 8). Mechanical properties of the pectin films which include tensile strength, elongation at break (EAB), and Young modulus (YM) were evaluated using a texture analyzer, with test speed set at 0.5 mm/sec. Meanwhile, the seal strength of pectin films was conducted according to ASTM F88/F88M-15 using a texture analyzer with a 200 mm/min rate of loading. Among all the pectin films, pectin film containing 30% of glycerin exhibited the highest tensile strength with optimum values of EAB and YM. All pectin films were heat-sealable at all heat levels. Heat seal strength of pectin films increased with the increase in percentage of glycerin of up to 30%, and thus signifies the maximum achievable heat-seal strength among all the pectin films.

Keywords: Pectin, glycerine, beeswax, mechanical, seal strength



ABSTRACT BOOK EDITORS

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