Book of Abstract

INTERACTIVE POSTER COMPETITION:

The 11th Southeast Asian Agricultural and Food Engineering Student Chapter Annual Regional Convention 2025 (ARC2025)

Intelligent Agriculture and Novelty in Agro-food Industry for Wellness

February 25 – 26, 2025
Maejo University
Chiang Mai, Thailand

Preface

In an era of rapid technological advancement, interdisciplinary collaboration is crucial for driving progress in the agricultural and food industries to meet the evolving needs of society. The 11th Southeast Asian Agricultural and Food Engineering Student Chapter Annual Regional Convention 2025 (ARC2025), held from February 24–26, 2025, in collaboration with the Faculty of Engineering and Agro-Industry, Maejo University, and the Malaysian Society of Agricultural and Food Engineers (MSAE), served as a vital platform for knowledge exchange.

Under the theme "**Intelligent Agriculture and Novelty in the Agro-food Industry for Wellness**," ARC2025 highlighted the application of emerging technologies and innovations to enhance health and sustainability in these sectors. The conference featured a diverse range of activities, **including 60 poster presentations**, fostering academic discourse, collaboration, and networking among participants from across Southeast Asia.

We extend our sincere gratitude to all participants and judges for their valuable contributions to the ARC2025 Interactive Poster Competition. We hope this session serves as a dynamic platform for fostering academic growth and innovative solutions, paving the way for a more sustainable future in agriculture and the agro-food industry.

ARC 2025 Poster Organizing Committee
February 2025

Interactive Poster Competition Agenda

The 11th Southeast Asian Agricultural and Food Engineering Student Chapter Annual Regional Convention 2025 (ARC2025)

February 25-26, 2025

Maejo University, Chiang Mai, Thailand

Time	Activity	Location
February 25, 2025		
1:00 PM – 3:00 PM	Poster registration and display setup Judge registration	Engineering Bldg. Faculty of Engineering and Agro-Industry, Maejo University
February 26, 2025		
10:00 AM – 12:30 PM	Interactive poster presentation	
12:30 PM – 03:30 PM	Lunch time Industrial guest speaker	Engineering Bldg. Faculty of Engineering and Agro-Industry, Maejo University
03:30 PM – 05:00 PM	Victory and closing ceremony	

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Agricultural Engineering

AGE-01

Design of a Low-Cost Coffee Cherry Ripeness Grading System Using Image Processing

Suksan Chomtanong[1], Chakrit Kanjana[1], Patiphat Sillapee[1], Kittisak Phetpan[1*], Natrapee Nakawajana[1], Pramote Kuson[1], Nuttapong Ruttanadech[1]

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Abstract

The objective of this research was to design a low-cost coffee cherry ripeness grading system using image processing. The system consisted of a camera module (Raspberry Pi Camera V2) for capturing video and a single-board computer (NVIDIA Jetson Nano) for image processing. It was designed to employ the HSV color space for image analysis and to classify four ripeness stages: Green (Unripe), Yellow (Ripe 1), Orange (Ripe 2), and Red (Ripe 3). Based on the experiment, the system achieved grading performance with an average percentage error of 4.9, 20.2, 29.3, and 37.4% for the unripe, ripe 1, ripe 2, and ripe 3 stages, respectively, with precision indicated by the standard deviation (SD) of percentage errors 3.1, 4.6, 3.4, and 8.4%, respectively. These results confirm that the system performed well in identifying unripe coffee cherries and could be applied in the cherry quality evaluation process to improve payment reliability for coffee group community enterprises.

Keywords: Machine vision, Camera, Color analysis, Classification, Fruit sorting

AGE-02

Profeed: Automated Poultry Food Feeder

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Abstract

This project presents the development of an automatic chicken feeder designed to streamline feeding processes and enhance feed efficiency in poultry farming. The problem addressed is the need for a reliable, consistent, and efficient feeding system that reduces labor and minimizes feed waste, which is often observed in traditional manual feeding methods. The purpose of this study is to develop a low-maintenance feeder that can autonomously dispense feed according to preset schedules or based on the chickens' feeding behavior. In designing the automatic feeder, we employed microcontroller technology and sensors integrated with an Arduino board, providing a cost-effective and flexible solution. Key components include a load sensor to monitor feed weight and a servo motor to control the dispensing mechanism. The system is programmed using Arduino IDE software, which enables real-time control and adjustments. Furthermore, to ensure optimal performance, we used a mobile app for remote monitoring, which allows for real-time notifications and control of the feeder's operation. Engineering analyses focused on the mechanical design to ensure a smooth, jam-free dispensing system, while electronic design considerations centered on power efficiency and reliable sensor interfacing. We expect the automatic feeder to maintain a consistent feed level, with data trends indicating reduced waste and improved feed conversion rates in poultry. Observations during testing should reveal that feed is dispensed uniformly, aligning with targeted schedules or trigger signals from sensors. Overall, the results are anticipated to show a significant reduction in labor and an improvement in feed efficiency. In conclusion, this automatic chicken feeder represents a practical solution to enhance poultry farming practices by reducing human intervention and feed waste. We recommend that future improvements focus on solar power integration for enhanced sustainability and the addition of an adaptive AI algorithm for predictive feed management.

Keywords: Automatic chicken feeder, Poultry farming, Feed waste reduction

AGE-03

The 3-in-1 Seedponic Rack

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Abstract

In navigating the currents of modernization, it can be observed that fewer people, especially those living in urban areas, are involved in farming activities. This study explores the need for innovative technology to address these circumstances. The 3-in-1 seedponic system is designed to improve productivity for small-scale farming by merging modern and traditional farming methods. The seedponic integrated farm system combines seedling, hydroponic, and vertical farming systems. The study highlights that the innovations used for efficiency in the agriculture sector have a significant positive impact on farmers. These innovations have been implemented in the product, which is a vertical farming system designed to boost productivity, and the seedling compartment can contribute to saving space. Ultimately, this approach not only addresses current challenges but also sets a foundation for sustainable agricultural practices in the future.

Keywords: Hydroponic systems, Seedling, Vertical farming, Seedponic rack, Modern farming.

AGE-04

Comparison of the Quality and Quantity of Biochar Produced from a Conventional Kiln and a Modified Kiln

Namthip Rianchan[1], Sunisa Phangate[1], Suphatta Inpikka[1], Kanyawee Sriboonma[1]*, Thanadon Roekdee[1], Numpon Panyoyai[1]

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Abstract

This research compares the performance of two biochar kilns, the conventional biochar kiln (Kiln A) and the modified biochar kiln (Kiln B), by analyzing moisture content, pH levels, electrical conductivity (EC), and biochar yield to assess their quality and production efficiency. The experimental results reveal that Kiln B produces a higher biochar yield (35% compared to 30%), lower moisture content, and fewer non-biochar byproducts (22.25% compared to 32.50%). Furthermore, Kiln B demonstrates higher electrical conductivity (427.61 µS/cm) and a more neutral pH value of 7.10, compared to the pH value of 8.10 observed in Kiln A, making it more suitable for soil improvement and agricultural applications.

The findings indicate that Kiln B offers superior production efficiency in terms of both the quantity and quality of biochar, reduces waste, and enhances practical usability. This research contributes to advancing biochar production technology, promoting agricultural and environmental sustainability.

Keywords: Biochar, Kilns, Production efficiency

AGE-05

Development of an Automated Pest Monitoring System for Cacao Pod Borer in Cocoa Plantations (Mopeco)

Nur Afrina[1], Siti Amni[1], Afifah Humaira[1*], Muhammad Afif[1], Nuraini[1], Hamdan[1]

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Abstract

The cacao pod borer (CPB) (*Conopomorpha cramerella*) is an invasive insect that causes significant economic losses to cacao farmers. To address this issue, CPB populations must be closely monitored using environmental data and pest population trends, enabling data-driven decision-making for precise pest control strategies. Sticky paper traps are widely used for pest monitoring due to their simplicity and cost-effectiveness. However, counting and classifying small insects on sticky paper under controlled lighting conditions is labor-intensive and prone to human error. This study aims to develop an automated pest monitoring system that captures images of sticky traps and calculates the number of CPB using the YOLO (You Only Look Once) image processing algorithm. The system incorporates an ESP32-CAM for image acquisition, a DHT22 environmental sensor for recording temperature and humidity, and a custom housing for protection. By integrating insect counts with environmental data, the study seeks to explore the relationship between CPB activity and environmental factors such as temperature, humidity, and time. The expected outcome is a reliable, automated system that provides actionable information for more efficient and accurate pest control strategies, contributing to sustainable cacao farming practices.

Keywords: Cocoa pod borer detection, Yolo system, Climate change, Arduino system

AGE-06

Design and Implement IoT Based Greenhouse System

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Abstract

This project focuses on optimizing Pak Choy growth using an IoT-based greenhouse system with vertical hydroponic towers. The greenhouse system is designed to maintain optimal conditions by monitoring and adjusting temperature, humidity, light intensity, and detecting wind using sensors connected to an ESP32 microcontroller. Data collected is integrated into a web application (ThingSpeak) for real-time monitoring and automation. The study takes place at PPK Lubuk Batu, utilizing a portion of a commercial vertical hydroponic tower farm greenhouse. The research evaluates the impact of planting density on Pak Choy growth and yield, comparing full-density (50 plants per tower) and half-density (25 plants per tower). Results show that while full-density towers yielded a higher total output (15.41 kg), half-density towers achieved superior quality and individual plant performance. Pak Choy in half-density towers exhibited an average fresh weight of 81.7 - 87.1 g per plant, significantly higher than the 54.4 - 59.9 g per plant from full-density towers. Furthermore, half-density towers exclusively produced Grade A Pak Choy, whereas full-density towers yielded a mix of Grade A and Grade B plants. These findings underscore the efficiency of half-density planting in vertical hydroponic systems for enhancing both quality and economic returns. Despite a lower total yield compared to full density, the higher individual plant yield and exclusive production of Grade A quality Pak Choy make the half-density approach more economically viable and sustainable. This study contributes valuable insights into optimizing urban farming practices through IoT-enabled greenhouse systems, emphasizing quality over sheer quantity in agricultural production.

Keywords: Vertical hydroponic tower, IoT, Sensors, Pak choy, Planting density

AGE-07

Compost Bin: A Smart and Efficient Solution for Urban Composting

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Abstract

The compost bin is an innovative solution designed for easy and efficient composting, ideal for small spaces like urban homes. With a compact size of 45.5cm diameter × 51 cm height and 12L capacity, it able to process around 11L of organic waste per cycle, producing approximately 6 kg of nutrient-rich compost. This efficient design encourages sustainable living by transforming kitchen waste into valuable compost, promotes waste reduction, and soil enrichment for eco-friendly households. Constructed from durable plastic, the bin resists cracks and wrapping, ensuring the product's longevity and reduce the initial cost production. Its non-porous surface prevents odor absorption, while user-friendly lid openings and an integrated odor control system simplify waste management. The compost bin features a manual rotating mechanism to improve airflow and speed up decomposition. Aeration holes ensure aerobic conditions, preventing odors caused by anaerobic decomposition. Additionally, the compost bin is also equipped with pH and humidity sensors, enabling real-time monitoring of the composting conditions. The pH is maintained at optimal range of 6.5–7.5 for microbial activity and nutrient availability, while the humidity is kept at 40–60%, enabling faster decomposition in 4-6 weeks compared to the conventional composting methods which requires 3-6 months.

Keywords: Compost bin, Urban composting, pH sensor, Humidity sensor, Microbial activity, Moisture level, Nutrient-rich compost

AGE-08

Evaluating Solar Powered Irrigation System for Herbal Cultivation

Nurul Iman Azman[1*], Harrison Fellix Liaw Anak Robin[1], Muhammad Ammar Muhamad Yusri[1], Mohd Saiful Akbar Mohamad Sahal[1], Mohd Ashraf Zainol Abidin[1]

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Abstract

A solar-powered herbal cultivation irrigation system was developed to optimize water use efficiency (WUE). To meet the Sustainable Development Goals (SDG) 2030 agenda of ensuring affordable and clean energy, solar energy is utilized using solar panels, reducing reliance on fossil fuels. Andrographis paniculata, a medicinal herb, was chosen to be cultivated using this system. The irrigation system was developed using a resistive soil moisture sensor and a 12VDC R385 diaphragm water pump connected to an Arduino microcontroller. The system was powered by 3 solar panels 10 watts connected in series, a 12V 20A solar charger, and a 7.2Ah battery. The soil moisture sensor was calibrated by determining the minimum and maximum values of sensors in dry and saturated wet soil respectively. Real-time soil moisture monitoring ensured that irrigation began when moisture levels dropped below the wilting point and stopped once field capacity was reached. To ensure the pump operation system is efficient, a delay of 5 seconds is applied in the programming code. The results show that irrigation systems can enhance water efficiency and conserve resources. This approach minimizes labor and promotes sustainability by combining renewable energy with smart irrigation, enabling the eco-friendly cultivation of medicinal plants in water-scarce regions.

Keywords: Andrographis paniculata, Irrigation, Solar photovoltaic, Renewable energy, Water use efficiency (WUE)

AGE-09

Sustainable Vegetable Production in Controlled Greenhouse

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Abstract

Vegetables are crucial for human health, rich in essential minerals. However, climate change disrupts their production through extreme weather and pests, often leading to harmful pesticide use. Greenhouse technology provides a sustainable solution, protecting crops from climate impacts, reducing pesticide reliance, and ensuring safer, more consistent vegetable supply. In tropical regions like Thailand, greenhouses face the challenge of excessive heat accumulation, which can hinder crop growth. This study focused on managing climate conditions within a closed greenhouse measuring 4 m in width, 8 m in length, and 3 m in height. The greenhouse was constructed with polyethylene plastic covering its walls and arched roof, which was equipped with a shading net. A cooling system with evaporative pads was installed, featuring 1.8 x 3.6 m² pads with a thickness of 0.15 m, a 0.5 HP water pump, two 27 W ventilation fans, and four 0.25 HP exhaust fans. An Arduino microcontroller was used to monitor relative humidity and air temperature, maintaining optimal Vapor Pressure Deficit (VPD) levels. The system was tested by cultivating Green Oak and Green Iceberg lettuce. Results showed yield increases of 27.70% and 12.85%, respectively, compared to crops grown outside the greenhouse.

Keywords: Greenhouse, Climate control, Lighting, Evaporative cooling system

AGE-10

INDA: An IoT- Enabled Algorithm for Precision Nutrient Dosing in Hydroponic

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Abstract

Hydroponic agriculture requires meticulous and precision regulation of nutrient levels and pH values to achieve an optimal plant growth. Nevertheless, many current auto-dosing systems are either expensive and lack cloud monitoring capabilities. This research introduces an IoT-enabled auto-dosing system that features the Intelligent Nutrient Dosing Algorithm (INDA). INDA algorithm accurately measures the amount of fertilizer and activates the mechanism to deliver it into the hydroponic system. System includes sensors that allow for real-time cloud-based monitoring key parameters and utilize actuators to modify the nutrient concentrations and pH levels within the tank. This research further assesses the effectiveness of the auto-dosing system by analyzing the fertilizer homogenization in relation to time relative to tank volume and desired EC values. This innovation offers an automated solution for nutrient management in hydroponic farming.

Keywords: IoT-enabled system, Cloud-based monitoring, pH regulation, EC value adjustment and precision agriculture nutrients

AGE-11

IoT-Based Sensor for Water Quality Monitoring in Aquaculture System

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Abstract

Recirculating Aquaculture Systems (RAS) support fish farming by recycling water through various components such as mechanical filters and biofilters; however, the presence of these technologies can create instability in the water body, leading to disturbances like air bubbles and water movement. This study evaluates the effectiveness of low-cost IoT water quality monitoring systems in aquaculture. The objectives are to determine the accuracy of data obtained from temperature, pH, and dissolved oxygen (DO) low-cost sensors. This study focuses on three low-cost sensors: the DS18B20 temperature sensor, the SEN0161/SEN0169 pH sensors, and the SEN0237 dissolved oxygen (DO) sensor, all tested in a container with air bubbles and water movement. Data from these sensors were sent to Google Sheets and Telegram to compare with the industrial-grade YSI sensor for evaluation. The results show that the maximum R2 for DS18B20 is 0.99, SEN 0169 is 0.57, SEN 0161 is 0.28 and SEN 0237 is 0.72. The results show that DS18B20, SEN 0169 and SEN 0237 show its accuracy while SEN 0161 pH sensor exhibited low accuracy.

Keywords: Recirculating aquaculture systems (RAS), Temperature, pH, DO, Accuracy

AGE-12

Irrigation Release Optimization

Nurfatila Binti Mohd Rosdi[1*], Jaimie Genius Jaimeh @ Jaimit[1], Muhamad Amir Faiz Bin Mohd Badran[1], Muhammad Azhar[1], Marini Zahirah Binti Mohamad Shukri[1], Muhammad Adib Mohd Nasir[1]

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Abstract

Efficient water and energy management is crucial for sustainable agricultural systems, particularly in minimizing water wastage and ensuring precise irrigation. This project explores the integration of a solenoid valve controlled by an Arduino-based moisture sensor system to optimize water delivery in small-scale agricultural setups. The primary objective is to develop a cost-effective, automated solution that prevents water leakage from poly bags while maintaining optimal soil moisture levels for Pak Choi cultivation. Key efforts include calibrating the moisture sensor to trigger solenoid valve operation and evaluating system performance under varying soil conditions. The design leverages real-time sensor data to ensure precise water delivery only when needed, significantly reducing water wastage and energy consumption. Preliminary results demonstrate that the automated system effectively maintains soil moisture within the desired range, preventing over-irrigation or under-irrigation. The solenoid valve offers reliable, leakage-free operation, while the Arduino-based control system ensures efficient, low-cost implementation. This project highlights the potential of integrating smart irrigation technologies to enhance water efficiency and sustainability in agriculture. Future work includes scaling the system for larger applications and exploring renewable energy sources to further reduce energy dependency.

Keywords: Smart irrigation, Moisture sensor, Water efficiency

AGE-13

Eco-Friendly Bird Repellent for Sustainable Agriculture

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Abstract

Bird activity poses a major threat to grain storage and agricultural output, causing significant financial losses for farmers worldwide. Current deterrent technologies, such as computer vision-based approaches and acoustic repellents, face challenges like habituation, limited adaptability, and imprecise detection, reducing their long-term effectiveness. This study aims to develop an advanced bird deterrence system integrating a passive buzzer for adaptive sound emissions, PIR sensor for precise motion detection, ultrasonic sensor for distance measurement, and an ESP32-CAM for image-based validation. The system uses modern engineering tools, including Arduino IDE for logic development and microcontrollers for sensor integration. The ESP32-CAM captures images of the area, enabling visual confirmation of bird presence and improving detection accuracy. The passive buzzer dynamically adjusts sound frequencies to deter birds and minimize habituation. Controlled environments will be used for modelling and testing to ensure system accuracy and reliability. The project incorporates power efficiency, optimized coverage, and strategic sensor placement. Expected outcomes include improved detection rates in complex scenarios, fewer false positives through image validation, and reduced bird habituation due to adaptive sound patterns. Observable data should demonstrate enhanced deterrent efficacy over longer periods compared to static systems. This experiment highlights how combining motion detection, adaptive sound emissions, and image verification can produce a more accurate and dynamic bird deterrent. Farmers can benefit from reduced crop damage, increased yields, and a scalable, user-friendly solution. Future recommendations include integrating IoT capabilities for real-time monitoring and remote adjustments and testing in diverse field conditions.

Keywords: Bird deterrence, Adaptive sound emissions, Image-based validation

AGE-14

Design and Build of a Coffee Fruit Color Sorting Machine

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Abstract

This thesis aimed to design and build a fresh coffee fruit color sorting machine using a color sensor. The machine was designed to separate fresh coffee fruits into red and green groups. Testing was conducted to determine the optimal rotational speed of the motor, which drives the conveyor wheel at speeds of 4, 5, 6, 7, and 8 rpm. The sorting performance results were 18.62, 23.22, 27.59, 32.16, and 33.07 kg/hr, respectively. Additionally, findings on sorting efficiency indicated that the optimal speed was 6 rpm, which achieved a maximum color sorting efficiency of 96.74%, with a sorting performance of 27.59 kg/hr and an average adulteration rate of 0.09. At this speed, the machine demonstrated high sorting efficiency, a low adulteration rate, and medium performance, making it suitable for farmers to use without causing any detectable damage to the coffee fruits.

Keywords: Coffee fruit, Color sorting, Sorting machine

AGE-15

EcoMush: Revolutionizing Mushroom Cultivation with Automated Incubation

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Abstract

This research focuses on developing an automatically controlled environment block for mushroom cultivation. The aim is to maximize mushroom production by providing an optimal living environment. To achieve this, a prototype was created to observe mushroom growth and compare production with traditional cultivation methods. Data were collected from the prototype, traditional methods, and standard results from research papers, and were analyzed and compared across these three scenarios. The results indicate that mushrooms grown in the automatically controlled environment grow faster and yield more than those grown using traditional and standard methods. This study also highlights that pallets can be recycled and turn into this mushroom incubator. In conclusion, the detachable automatic mushroom incubator provides an optimal environment for mushroom growth, significantly increasing production. This study contributes to the mushroom production and food industry by integrating automation technology into agriculture.

Keywords: Mushroom cultivation, Automation farming, Mushroom incubator, Sustainable, Control environment

AGE-16

2 in 1 Fruit Harvester

Siti Aisyah Binti Saiful[1], Nur Hurin Husna Binti Rafee[1], Hajar Syahirah Binti Yusri[1], Juniza Binti Md Saad[1*]

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Abstract

This research explores the design and application of a compact, budget-friendly 2-in-1 Multi-Fruit Harvester intended for small-scale agricultural operations. The device provides an affordable and practical solution for farmers to effectively gather different types of fruits, such as rambutan and langsat, in a single process. Made up of three primary components, the harvester is engineered for simplicity, portability, and durability. Using the Blynk app, we sketched and developed the initial design before finalizing the product. By utilizing recyclable materials in its construction, it ensures both cost efficiency and environmental sustainability. Testing results showed that the 2-in-1 Multi-Fruit Harvester effectively improved collection efficiency, minimizing labor efforts and time requirements. The study concludes that this inventive tool offers farmers a reliable and efficient solution, enhancing productivity and supporting sustainable farming practices.

Keywords: Harvest technology, Fruits, Machinery

AGE-17

Integrating Internet of Things (IoT), Sensor, Computer Vision, and AI-Based Systems for Monitoring Bee Pollinators and Enhancing Agricultural Pollination Efficiency

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Abstract

An integrated approach for optimizing agricultural pollination merges Internet of Things (IoT), sensors, computer vision, and deep learning to monitor, and optimize natural pollinator habitats, such as bees. This approach uses IoT sensors to continuously monitor environmental parameters, including humidity, temperature, and CO_2 levels, which directly impact pollination activities. Computer vision and sound recognition tracks bee pollinators, identifying patterns and behavior that contribute to pollination rates. The gathered data, processed through deep learning algorithms, enables real-time analysis of factors influencing pollinator efficiency, offering insights into environmental and ecological influences on crop yield. This method facilitates a proactive and responsive pollination monitoring system, capable of adapting to changing environmental conditions and enhancing pollination timing and efficiency. By leveraging this data-driven model, farmers can make informed decisions to promote more sustainable pollination practices, ultimately enhancing crop productivity and resilience. Integrating IoT, sensors, and computer vision fosters an advanced pollination support system, which could lead to reduced reliance on manual monitoring and intervention. Such an approach not only optimizes resource use but also contributes to more sustainable agriculture, ensuring higher yields and improved food security.

Keywords: Computer vision, Deep learning, Internet of things (IoT), Pollination, Sensor

AGE-18

Cotton Plant Disease Detection Using Ensemble Learning to Increase Agricultural Effectiveness and Welfare of Women Farmers in Sumba Island, Indonesia

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Abstract

Due to prolonged drought, Women farmers in Sumba, East Nusa Tenggara, Indonesia are forced to turn their farm into cotton farm in order to make income. Unfortunately, 40% of cotton crops are always infected with disease like Angular Leaf Spot, Wilt Disease, Root Rot, Boll Rot Disease and many more. To address this, ensemble learning, a combination of multiple machine learning, is used to identify early signs of diseases in cotton plants. From literature review, several machine learning appears to be promising. Convolutional Neural Network (CNN) by image detection of plant leaves and stem disease displays 98,5% accuracy. While for root disease, since image scanning isn't possible, Ground Penetrating Radar (GPR) shows potential to detect plant root disease. Furthermore, maintaining water level of cotton crops is also crucial. Long Short-Term Memory-CNN combined algorithm proven to detect water level with a 97.3% accuracy. Lastly, as the hardware, a tool in the form of FarmersCart is made. This cart consists of GPR radar for root detection, ParrotSequioa+ camera for leaf scanning, LCD for display and an antenna for receiver. Implementing this practical cart, women farmers can detect disease earlier and halt spread of infection.

Keywords: Cotton plant, Ensemble learning, Plant disease, Sumba Island

AGE-19

Maturity Evaluation of Monthong Durian Using Gas Sensors and Artificial Neural Network

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Abstract

Durian is the King of fruits (King of fruits) in Thailand and durian is considered an important fruit of Thailand aside from being consumed domestically, it can also be exported to generate a large amount of income for the country each year. The study used the Mon Thong durian variety of ages ranging from 120 to 128 days (Days after Anthesis, DAA) for the experiments. Four types of gas sensors were used: MQ3, MQ6, MQ-136, and ZE11-C2H4 Ethylene, to investigate the relationship between the voltage from the gas concentration and the percentage of dry weight (%DW). The experimental results showed that the model's error rate was 0.0004, with 12 hidden layers and 2933 training iterations, taking 30 minutes to process. The ripeness levels of durians were classified into three categories unripe, ripe, and overripe, with dry weight percentages of 32.56, 34.33, and 29.43%, respectively. The classification accuracy rates were 100.00, 77.80, and 86.70%, respectively. This demonstrates that the ANN model can effectively classify the ripeness levels of durians, with an average accuracy of 88.10%.

Keywords: Maturity evaluation of durians, Artificial neural network

AGE-20

Drone Thermal and High-Resolution RGB Camera with Machine Learning for the Detection of Ganoderma Disease in Oil Palm Plantation

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Abstract

Oil palm crops are highly susceptible to basal stem rot (BSR) disease caused by the Ganoderma boninense fungus. BSR can be identified by foliar symptoms such as several unopened spears, flat crowns, and a small crown size. This study aimed to explore the potential of using high-resolution RGB and thermal spectral images from aerial photography to identify and classify BSR-infected trees. A DJI Inspire 2 drone was used to capture the aerial images, with the MicaSense Altum-Pt sensor obtaining the thermal images and the DJI Zenmuse H20 camera capturing the high-resolution RGB aerial images, followed by image processing. The oil palm trees were categorized into four severity groups: T0 (healthy), T1 (mildly infected), T2 (moderately infected), and T3 (severely infected). The analyzed features included frond angle, frond number, crown area, thermal pixel intensity, and RGB vegetation indexes such as the Normalized Green-Red Difference Index (NGRDI), Modified Green-Red Vegetation Index (MGRVI), Normalized Difference Yellow Index (NDYI), Colour Index of Vegetation Extraction (CIVE), and Visible Atmospherically Resistant Index (VARI). These features were then combined using Principal Component Analysis (PCA) to capture the most significant variance in the dataset. For the machine learning approach, the results from PCA yielded high test accuracy overall, with Fine KNN, Weighted KNN, Ensemble Subspace KNN, and Wide Neural Network being the best classification models, achieving 100% accuracy. This novel method of using high-resolution aerial and thermal spectral images offers a promising approach for detecting and classifying BSR-infected oil palm trees, which could aid in better disease management and potentially increase oil palm yield.

Keywords: Oil palm, Basal stem rot (BSR), Ganoderma boninense, Aerial photography, Thermal spectral images, DJI Inspire 2, MicaSense Altum-Pt, DJI Zenmuse H20, PCA, Machine learning, NGRDI, MGRVI, NDYI, CIVE, VARI, Fine KNN, Weighted KNN, Ensemble subspace KNN, Wide neural network, Disease classification

AGE-21

Enhancing Shine Muscat Grape Supply Chain Transparency and Efficiency through IoT and NFTs: A Solution for Quality, Safety, and Sustainability

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Abstract

The increasing demand for transparency and safety in the food supply chain necessitates innovative solutions. This study presents an integrated system leveraging blockchain, RFID, and IoT technologies to enhance the traceability and quality assurance of Shine Muscat grapes. The proposed solution combines tamper-proof smart labels, equipped with RFID chips and QR codes, with IoT-based chemical detection devices. These technologies enable real-time monitoring of hazardous residues, such as pesticides and heavy metals, while storing immutable data on blockchain for secure and transparent access. Shine Muscat grapes, a high-value agricultural product with global consumption exceeding $60 million annually in markets like South Korea and China, serve as a case study for implementation. By linking physical product attributes to blockchain-secured digital identities, the system ensures data integrity and facilitates consumer access to comprehensive product information, including origin, safety tests, and transport conditions. The results highlight significant potential for improving food safety, consumer trust, and operational efficiency. Moreover, this approach addresses critical challenges in the agricultural supply chain, such as fraud prevention and regulatory compliance. By bridging advanced digital technologies with sustainable agricultural practices, this innovation establishes a new benchmark for quality assurance and traceability in the global food industry.

Keywords: Blockchain, IoT, Shine muscat grape, Supply chain transparency, Traceability

AGE-22

Smart Tractor for Automatic Plant Irrigation

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Abstract

The agricultural sector is currently facing complex challenges, including low productivity which causes fluctuations in supply and demand between regions. One of the agricultural concepts based on digital and information technology is Smart Farming, which aims to increase productivity, efficiency and sustainability in the crop production process. Smart Farming is a farming concept that relies on advanced technology such as big data analytics, robotics, cloud storage, artificial intelligence (AI), and internet of things (IoT). Cultivating land, fertilizing and providing water using tractors is currently operated manually by farmers directly driving it. Smart Tractor for Automatic Irrigation is an unmanned tractor that uses sensors and microcontrollers for its operation. The tractor will work automatically according to the sensor readings it receives. Apart from increasing productivity and efficiency, the use of a smart tractor can provide tracking of plant conditions which are read by sensors as material for evaluation.

Keywords: Automation, Irrigation, Smart farming, Tractor

AGE-23

Integrated Real Time Elephant Detection and Alarm System (i-ReDA)

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Abstract

The increasing human population growth near forest areas has led to rising conflicts between humans and elephants. Human-wildlife conflict has become a critical issue, leading to significant economic losses and potential harm to humans and animals. These conflicts also lead to the destruction of agricultural fields, lands, and disruption of transportation. This project aims to develop real-time elephant detection and alarm system using IoT and machine learning. The system integrates an Internet of Things (IoT) and machine learning algorithms to detect the presence of elephants using Gravity HuskyLens - AI Machine Vision Camera. Once an elephant is detected, the system triggers an alarm mechanism using bee sounds by DFRobot MP3 player and LM386N-4 amplifier. Then, a system sending real-time alerts to farmers or wildlife authorities through a mobile application powered by solar system. This project could provide effective monitoring and early warning capabilities. This system is also designed to be cost effective and energy efficient. This system can be commercialized for wildlife conservation and agricultural protection. It contributes to reducing human elephant conflicts and enhancing the safety of rural communities. As conclusion, this project can support SDG2 in ensuring food security by preventing crops damage; and SDG15 life on land by fostering sustainable wildlife management.

Keywords: Elephant detection, Alarm system, Internet of things (IoT), Human-wildlife conflict

AGE-24

Q-SenseAgri: Quantum Sensor Technology for Early Detection of Plant Stress on Potato to Reduce Chemical Use in Agriculture

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Abstract

The increasing demand for sustainable agricultural practices necessitates innovative solutions for early detection of plant stress, particularly in high-value crops such as potatoes. This study explores the application of quantum sensor technology as a novel approach for monitoring plant health and stress levels in potato cultivation. In 2022, potato production in Indonesia reached 1,503,998 tons, but this figure declined to 1,248,513 tons in 2023, highlighting the impact of various stress factors on yield. Quantum sensors offer high precision in measuring environmental variables, allowing for timely interventions to mitigate stress caused by factors such as drought, nutrient deficiency, and pest infestations. By facilitating real-time data collection and analysis, these sensors enable farmers to make informed decisions, optimizing resource use and reducing reliance on chemical inputs. The implementation of quantum sensor technology can enhance crop resilience, improve yield quality, and contribute to more sustainable agricultural practices, ultimately aligning with global efforts to promote food security while minimizing environmental impact. This research underscores the potential of integrating advanced sensing technologies in modern agriculture to address the challenges posed by climate change and resource scarcity.

Keywords: Quantum Sensor, Agriculture, Technology

AGE-25

Integration of Computer Vision and CNN (Convolutional Neural Network) to Identify Carotenoid Content and Ripeness of Orange Fruit (*Citrus reticulata*)

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Abstract

Oranges are one of the local fruit varieties originating from Asian countries. According to the Central Statistics Agency of Indonesia, the production of oranges in 2021 reached 4.6 million tons. Oranges contain carotenoids, which have antioxidant properties. In previous research, carotenoid content testing was conducted using an extraction test and continued by analysis using KLT-Densitometry method, which was inefficient due to its long processing time, destructive nature, and inability to be performed in real-time. Therefore, an integration of computer vision using CNN was employed to identify carotenoid content in oranges. The CNN algorithm used in this project was developed using the MobileNetV3 CNN architecture because it provides the most optimal performance for this purpose. The mechanism of orange fruit carotenoid detection starts with feature extraction to extract several color features that are used as indicators of the presence of carotenoids in the orange fruit. After colors are extracted, the percentage of carotenoid content can be determined based on their colors. This has also been proven in previous research, which showed that this method can achieve an accuracy of 99.30%. This accuracy is sufficient for the algorithm to detect carotenoid content in oranges, giving this program several advantages over previous studies.

Keywords: Carotenoid, Machine vision, CNN, Orange

AGE-26

Goat Feeder Automation

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Abstract

This project aims to develop an automatic goat feeding system to enhance the effectiveness and efficiency of goat farming. The main issues identified include goats not being fed according to scheduled times, inconsistent feed quantities, and high labor costs. Therefore, the objective of this project is to design and build a goat feeder automation system that can automate feeding times and ensure consistent feed quantities according to the goats' requirements. The study results indicate that the automated system can reduce feeding time from 9.3 seconds manually to 0.7 seconds automatically, with a more consistent feed weight of 607 grams compared to 592 grams manually. Data analysis shows that the system not only reduces labor time but also improves the accuracy and efficiency of feed delivery. In conclusion, the developed goat feeder automation successfully meets the project's objectives by offering a more efficient, cost-effective, and practical solution for managing goat feeding automatically.

Keywords: Automatic goat feeder, Precession feeder, Labor cost reduction

AGE-27

Hydroponic System Analysis and Control (e-HSAC)

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Abstract

This project develops a smart hydroponic system using data analysis and automated control to optimize agricultural yields sustainably. Equipped with moisture, temperature, water level, and pH sensors, the system enables real-time monitoring to maintain optimal growth conditions. A microcontroller processes sensor data and adjusts water and nutrient levels automatically, reducing manual labor and resource use. Results show enhanced water and nutrient efficiency, faster plant growth, and improved yields. This system supports sustainable agriculture by conserving resources, reducing costs, and addressing climate challenges. It provides a resilient solution for modern farming amid natural resource shortages and weather unpredictability.

Keywords: Smart hydroponics, Automated control, Sustainable agriculture

AGE-28

Automated Waste Segregator

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Abstract

The Automation Waste Segregator project enhances waste management using automation technology, reducing manual labor while ensuring accurate and consistent waste segregation. Equipped with sensor-based detectors, including soil moisture and ultrasonic sensors, the system identifies waste types based on material properties like conductivity and density. Survey results show that over 80% agree the system efficiently separates waste, with users noting minimal odor from segregated wet waste. This innovative approach improves waste management efficiency and supports environmental sustainability, offering a practical solution for modern waste disposal challenges.

Keywords: Automated waste segregation, Waste management efficiency, Sensor-based detection

AGE-29

Hybrid Solar-Electric Dryer for Agricultural Products

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Abstract

Drying is an essential process in agriculture, but traditional methods often rely on energy-intensive techniques. Thailand's tropical climate offers abundant solar energy, making it ideal for solar drying. However, consistent drying conditions are crucial for maintaining high product quality. This agricultural engineering project developed a hybrid solar-electric dryer. The dryer consists of a direct solar drying chamber with dimensions (W x L x H) of 1 x 1.5 x 0.95 m, enhanced with two electric infrared heaters and an automatic control system to address the challenge of insufficient solar energy on days with unfavorable weather conditions. Drying tests for tofu were conducted in three modes: using solar energy alone, using an electric heater at 70°C, and using a hybrid solar-electric system at 70°C. The results showed that drying with the hybrid solar-electric system significantly reduced drying time by 26.32% compared to solar energy alone. Additionally, it decreased electrical energy consumption by 38.58% compared to the electric heater alone. This dryer can also be adapted for drying other agricultural products, such as mangoes, pineapples, and bananas.

Keywords: Hybrid solar-electric dryer, Agricultural products, Drying

AGE-30

Next-Generation Portable Weather Stations for Agricultural Applications

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Abstract

Agricultural productivity is highly dependent on accurate weather monitoring, yet traditional weather stations are often complex and costly. This study focuses on the development of a next-generation portable weather station designed for agricultural applications. The objectives include designing a weather station using readily available sensors, analyzing the sustainability of its electronic components in harsh weather conditions, and developing a low-cost prototype for field testing. A Computational Fluid Dynamics (CFD) analysis was conducted to optimize the electronic enclosure for efficient cooling and component longevity. The prototype successfully collected real-time data on key meteorological parameters such as temperature, humidity, atmospheric pressure, wind direction, wind speed, and precipitation. The results demonstrate the feasibility of an affordable, efficient, and reliable weather monitoring solution for farmers. Further research is required to enhance performance, durability, and affordability.

Keywords: IoT, Portable weather station, Computational fluid dynamics (CFD), Real-time data collection

AGE-31

Next-Generation Plant Regulators: Encapsulated Chitosan and Silica Nanoparticles for Sustainable Agriculture

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Abstract

Nanotechnology is revolutionizing agriculture by offering innovative solutions for sustainable plant growth. This study focuses on the synthesis and characterization of chitosan-silica (CS-Si) nanoparticles derived from shrimp shells and their application as plant growth regulators. The encapsulation of chitosan with silica nanoparticles enhances nutrient uptake, promotes root and shoot growth, and minimizes environmental impact. Hydroponic experiments were conducted to evaluate the impact of these nanoparticles on plant growth. Additionally, antimicrobial properties and water adsorption capacity were assessed. The results indicate that the synthesized CS-Si nanoparticles, with an average particle size of 20 nm, significantly enhance plant development. However, both chitosan and CS-Si nanoparticles exhibited minimal antimicrobial activity. Adsorption studies followed the pseudo-first-order and Langmuir models. The findings highlight the potential of CS-Si nanoparticles as effective plant growth regulators, paving the way for eco-friendly agricultural advancements.

Keywords: Chitosan-silica nanoparticles (CS-Si NPs), Nanotechnology, Sustainable agriculture, Plant growth regulators

Food and Bioprocess Engineering

FBE-01

Safety Food Growth Plus (SFG+)

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Abstract

The SFG+ innovation aims to protect fruits from pests and overripening using advanced packaging technology. This innovative packaging includes a colour indicator that signals the presence of pests and indicates when fruit is ripe, enhancing farmers' awareness. By managing ethylene levels, it maintains fruit quality and prevents over ripeness. This innovative project has strong commercial potential, benefiting farmers with freshness, ease of use, and improved product information. Combining shelf-life extension, customer engagement, and enhanced product transparency, the SFG+ innovation demonstrates a novel approach to maintaining agricultural produce quality from farm to consumer. The project has also received valuable feedback from 5-10 respondents on food packaging innovations.

Keywords: Advanced packaging technology, Ethylene management, Fruit quality

FBE-02

Innovative Approach to the Production Process and Physicochemical Characterization of Freeze-Dried Yogurt Powder

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Abstract

The study aimed to produce freeze-dried yogurt powder and evaluate the effects of maltodextrin and inulin on its physicochemical properties, along with a comparison of lactic acid bacteria in fresh and freeze-dried yogurt. Yogurt formulations included pasteurized milk, maltitol, maltodextrin, inulin, and yogurt culture, divided into three groups: (1) control with 20% maltodextrin (F-Control), (2) 10% inulin and 10% maltodextrin (F-IN10), and (3) 20% inulin (F-IN20). Results showed that 20% inulin (F-IN20) increased yogurt pH before freeze-drying due to enhanced bacterial fermentation. Inulin addition (F-IN10, F-IN20) did not significantly affect yield, moisture, bulk/tapped density, or flowability compared to F-Control ($p>0.05$), but 20% inulin (F-IN20) significantly reduced water activity ($p<0.05$). Increasing inulin (F-IN20) improved solubility but altered powder color ($p<0.05$) and increased hygroscopicity. The freeze-dried yogurt powder had excellent flowability and higher lactic acid bacteria counts than fresh yogurt (>1 x 10^6 CFU/g, dry basis), indicating high quality. Overall, 20% inulin enhanced solubility, reduced water activity, and improved the quality of the freeze-dried yogurt powder, highlighting its benefits as a prebiotic that contributes to the production of a more functional and nutritious yogurt powder.

Keywords: Yogurt powder, Inulin, Freeze drying, Physicochemical properties

FBE-03

Study of Factors Affecting the Culture Wolffia in Prototype Farms to Create the Future Food

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Abstract

This study aims to analyze the factors affecting the growth, growth rate, yield, and production efficiency of Wolffia in a prototype farm. The experiment was conducted under various conditions, including the amount of starter culture, water depth, concentration of hydroponic nutrients, water circulation, shading, water treatment, and pH control using CO2. The results revealed that 100 grams of starter culture and a water depth of 19 cm (150 liters) yielded the most effective propagation. Additionally, nutrient concentration at a 1:500 ratio and pH control at 5.5 using CO2 significantly enhanced growth and production efficiency. Water circulation through a pump system combined with ozone-UV filtration reduced contaminants, while shading with nets and screens reduced water evaporation and protected against insects. Optimizing these factors supports high-quality Wolffia production, making it a sustainable and viable source of protein for the future.

Keywords: Wolffia, The future food, Cultivation

FBE-04

Effect of Illumination and MJ-Hydroponics Nutrient Solution on Isolated Strain Plant of Wolffia Globosa Cultivation

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Abstract

This study aimed to analyze the effects of LED light and Maejo hydroponic solution on the growth, growth rate, yield, and efficiency of Wolffia Globosa cultivation. The experiment was conducted under various factors, including the type of light bulbs affecting growth, the height of LED and fluorescent light bulbs, light exposure duration, and the concentration of organic solution in each type of light. The experiment utilized 2 grams of Wolffia Globosa. The results showed that the seedlings exhibited optimal growth under LED light at a height of 30 cm with a 12-hour/day exposure. Additionally, the use of Maejo hydroponic solution at a concentration of 1:500 enhanced seedling growth. These findings indicate the optimal factors for cultivating Wolffia Globosa in a closed system, which can significantly improve both the yield and quality of Wolffia Globosa production.

Keywords: Wolffia Globosa, LED light, Maejo hydroponic solution, Light exposure duration, Closed system

FBE-05

Development of a Real-Time Notification System Using Line Notify

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Abstract

The development of a real-time notification system using Line Notify platform in conjunction with Google AppScript, Google Form, and Google Sheet has been applied to enhance the operational efficiency of the Maintenance Division, which is responsible for overseeing, controlling, installation, maintenance, and prevention of damage to machinery, electrical systems, and various equipment within food industry factories. The increasing number of machines in large industrial factories has resulted in delayed and error-prone work processes. Therefore, the development of a real-time notification system using Line Notify was implemented alongside Google App Script, Google Form, and Google Sheet to improve operational efficiency, reduce information transfer time, and minimize work errors. The system can provide real-time job status notifications, facilitating faster and clearer communication within the team. Data recorded through Google Form is processed in Google Sheet, which aids in precise data analysis and decision-making.

Keywords: Real-time notification, Line notify, Error reduction in work processes, Maintenance

FBE-06

Design of a Biomass Conveyor Belt Dryer Using a Hot Air System

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Abstract

Design and development of a belt-type biomass fuel dryer utilizing waste heat from exhaust vents aim to address the limitations of traditional drying methods under unfavorable weather conditions. The belt dryer is selected for its high efficiency, suitability for various materials, and capability to reduce the moisture content of biomass fuels, such as wood chips, to below 35%. The design considers key factors, including temperature control, airflow speed, and heat transfer, to achieve an efficient drying process. This dryer reduces drying time and costs while enhancing the quality of dried materials, making them more suitable for use in the biomass fuel industry.

Keywords: Belt-type dryer, Biomass fuel, Waste heat utilization, Moisture reduction, Drying efficiency

FBE-07

Development of Image Processing System to Identify Dehiscence Zone Coordinates for Durian Dehusking Robotics Arm

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Abstract

Peeling durian flesh requires skilled labor because the durian peel is hard and has thorns around the fruit. The purpose of this engineering project is to develop an image processing system and to identify the coordinates of durian dehiscence zone for a robotic arm for core peeling. The project was developed in two main parts: A durian image analysis system using YOLO V8 to detect the dehiscence zone and an image coordinate system using Python to guide a 6-axis robotic arm to move to target coordinates. Data collection and analysis were conducted under various lighting conditions in the field. Results showed that the image analysis system achieved 100% accuracy in detecting the dehiscence zone under all tested lighting conditions. The analysis efficiency in the evening was found to be higher than during midday, where light intensity is high. The mAP at IoU [0.5] was consistently close to 0.995 across all time periods. The average prediction error for coordinates was 1.70%, based on a 30x30 cm durian placement base. And the tolerance between the coordinates that the robot moved compared to the actual position was 3.08%, demonstrating the ability of the robotic arm to accurately locate the dehiscence zone.

Keywords: Image processing, Machine learning, Durian fruit, Dehiscence zone, Robotic arm

FBE-08

Kinetics of Lychee Wine Fermentation and Production Scale-up

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Abstract

The study aims to investigate the kinetics of lychee wine fermentation and apply the results to scale up production, ultimately improving the quality of the wine. The study evaluates the carbon source (from lychee juice sweetness at 22 degrees Brix) and nitrogen source (from Diammonium Phosphate, DAP) for the yeast Saccharomyces cerevisiae. The different conditions consist of condition 1: No DAP added, condition 2: 1 gram per liter of DAP and condition 3: 2 grams per liter of DAP. The result found that condition 2, with 1 g/L of DAP, exhibited the highest specific growth rate of 0.01024 h-1, with a high correlation coefficient (R2 = 0.9976) and acceptable statistical parameters (x2 = 0.4423, RMSE = 0.6368, MBE = 0.4055). Condition 2 was identified as the most efficient, converting the sweetness of lychee to alcohol in the shortest time. Therefore, this condition was selected for scaling up production. Such research can significantly contribute to optimizing fermentation processes and potentially improving the lychee wine industry's production standards.

Keywords: Fermentation kinetics, Concentrated lychee juice, Diammonium phosphate nutrient

FBE-09

Banana Sheet Pressing Machine Design

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Abstract

This project presents the design and structural modeling of a banana sheet pressing machine. The design incorporates a pressing mechanism with an adjustable pressure control system to optimize the pressing process for uniform sheet production. Finite element analysis (FEA) validates the durability and reliability of key components, while a preliminary economic evaluation estimates production capacity and operational costs. The design prioritizes structural integrity, ease of maintenance, and adaptability for commercial applications, offering a scalable and efficient solution for banana sheet production.

Keywords: Banana sheet, Pressing machine, FEA, Pressure control, Structural design.

FBE-10

Automated Corn Shelling Machine Development

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Abstract

This research aims to enhance the efficiency of corn shucking machines, which currently suffer from low productivity and contamination of the final product. This study analyzes the problems of conventional corn shucking machines by investigating the causes of low efficiency and contamination. Subsequently, the design and development of the corn shucking machine is improved to enhance its performance. The focus is on improving the blades and the length of the tube from the inlet to the blades to achieve higher quality products and reduce the amount of contaminants. After modifications, it was found that the corn shucking machine's efficiency could be increased by 33%. The most effective solution was to extend the length of the tube by conveying corn towards the blades.

Keywords: Automated corn shelling machine, Efficiency improvement, Contamination reduction

FBE-11

Design and Proof of Concept for Fruit Juice Squeezing Auxiliary Device

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Abstract

In mangosteen beverages production, juice extraction requires squeezing mangosteen pulp using a screw press. This project aimed to design the auxiliary press roller (APR) and pulp pre-grinding process (PGP) to improve the efficiency of the mangosteen screw press for juice extraction. The designed APR was equipped with a geared motor operating at variable rotational speeds and roller finished surface. Results indicated that the extraction capacity and efficiency of APR and PGP were 9.82 and 6.85 kg/min, and 0.411 and 1.43%, respectively. Compared to the original screw press which exhibited a capacity of 13.77 kg/min, the APR nor the PGP showed no significant improvement due to the pulp slippage and clogging during the screw-pressing process. Future studies are recommended to explore the use of a matte-finished surface to overcome the pulp slippage and clogging, potentially improving the efficiency of mangosteen juice extraction.

Keywords: Mangosteen juice, Screw press, Auxiliary press roller, Pressing efficiency

FBE-12

Melody: Moderate Electric Field Optimization for Dairy Yield

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Abstract

Innovative dairy technology is expected to maintain the nutritional quality of milk during and after processing. Milk has a relatively short shelf-life due to spoilage contamination. Therefore, the Moderate Electric Field (MEF) is considered as an innovative solution to reduce the high energy consumption of regular pasteurization due to the thermal process of spoilage inactivation. Through this method, the shelf-life of fresh light milk can be extended, energy consumption can be reduced, and nutritional quality is more effectively preserved than conventional methods. This study aims to develop MEF design and system control by Human-Machine Interface (HMI) integrated with the Internet of Things (IoT) system. A data logger, temperature and electrical sensors, and voltages ranging from 50 to 70 V were utilized in conjunction with these electrodes. The system may include a function generator connected to the HMI to modify the voltage and other parameters. Furthermore, to enhance usability, the MEF system can be accessed and controlled through software installed on a smartphone. This innovation focuses on improving wellness by extending shelf-life products and energy efficiency to enhance economic, social, and environmental sustainability.

Keywords: Milk shelf-life, Raw milk processing, Low energy, Internet of things (IoT)

FBE-13

MN Save Track

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Abstract

For industrial factories with continuous production, machine downtime due to breakdowns affects production efficiency and operating costs. This research aims to develop a maintenance tracking and data recording system by transforming it from an offline format to an online system through Google Sheet, making data management more convenient, faster, and reducing document loss issues. This new system applies the concept of Predictive Maintenance by analyzing actual machine usage data to prioritize equipment requiring maintenance and determine appropriate parts replacement cycles. The results of implementing the online system show that data recording has become more organized, users can access information in real-time, reducing document search time and increasing convenience in monitoring machine performance. Analysis of parts replacement cycles, such as gaskets in the can production line, found that adjusting replacement cycles based on actual usage helped extend parts lifetime and reduced costs by 14.21%. In conclusion, this developed tracking and maintenance system effectively improves management efficiency, reduces costs, and supports proactive maintenance in industrial factories.

Keywords: Preventive maintenance, Predictive maintenance, Online data management, Cost reduction in maintenance

FBE-14

Analysis of Kinetics Model from Hot Air Drying of Bananas

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Abstract

This study aims to develop a drying method for bananas (Namwa bananas) using hot air and to create a mathematical model for predicting the drying kinetics. The experiment was conducted using a tray dryer under controlled conditions, with varying temperatures of 70°C, 80°C, and 90°C, and different air velocities. Moisture content was measured at different times to calculate the drying rate constants and determine the most suitable mathematical model. The initial moisture content of fresh bananas was 66.15%, with an initial water activity (aw) of 0.959, and the drying process continued until the final (aw) was approximately 0.3. The results showed that the Modified Henderson and Pabis model best described the drying kinetics under all experimental conditions, with the highest R2value close to 1 and the lowest values for X2, RMSE, and MBE. The analysis revealed that temperature and air velocity significantly affected the moisture reduction rate of the bananas. The drying rate constants obtained from the experiment can be used to develop models for predicting optimal drying times, reducing energy costs, and enhancing efficiency in the production process.

Keywords: Namwa bananas, Drying, Drying kinetics, Chewy dried bananas, Mathematical model

FBE-15

Design and Development of Equipment for Controlling the Water Level in the Frozen Tuna Thawing Process to Reduce Wet Areas

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Abstract

The process of thawing frozen tuna using a High Voltage Electric Field (HVEF) system encounter challenges due to excessive water usage in the workspace. This leads to wet floors, resulting in material corrosion within the production area and compromising workplace safety. This research aims to design and develop equipment to control water levels in the HVEF thawing tank using a discontinuous siphon pipe for water filling and drainage. The percentage of wet surface areas before and after installing the equipment was compared. Experimental results showed that the percentage of wet floors was reduced by 82%, demonstrating the effectiveness of the equipment in maintaining water levels efficiently. Therefore, addressing wet floor issues is crucial for ensuring workplace safety, reducing workers' cleaning time, and extending the lifespan of production equipment.

Keywords: HVEF thawing system, Water level control, Workplace safety

FBE-16

Effect of Water Contamination in Refrigeration Systems

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Abstract

The study on the impact of water in a vapor compression refrigeration system using R717 (ammonia) as a refrigerant aims to measure the water content in the system using an Ammonia Test Tube and reduce it through a water distillation process. The presence of water in the system negatively affects the cooling performance. This research focuses on eliminating water to lower energy consumption and enhance the refrigeration system's efficiency. Reducing water content helps mitigate issues such as corrosion, scaling, and clogging within the system, resulting in improved heat transfer and reduced compressor workload. The findings demonstrate the effectiveness of the distillation process in decreasing water content and its positive effects on the refrigeration system's overall performance.

Keywords: Water impact, Ammonia test tube

FBE-17

Optimizing of Temperature and Time for Dried Cocoa Nibs

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Abstract

This study aims to determine the optimal temperature and time for cocoa bean roasting to enhance the quality of cocoa nibs. Key parameters such as moisture content, water activity (aw), and color values (Hunter L*a*b*) were analyzed. The experimental results indicate that controlling temperature and time at optimal levels significantly improves the physical and chemical properties of cocoa nibs while extending their shelf life. Furthermore, the findings highlight the potential for application in the food industry to optimize production processes and develop higher-quality cocoa products.

Keywords: Cocoa bean roasting, Optimal temperature and time, Cocoa nibs, Physical and chemical properties

FBE-18

Plasma Bubble-Activated Water

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Abstract

Currently, consumers are increasingly consuming fresh vegetables as they are a vital source of essential vitamins and minerals. However, consuming fresh vegetables carries the risk of microbial contamination, such as Escherichia coli and Bacillus subtilis, which can pose health risks. This research aims to develop plasma bubble-activated water disinfection technology to enhance the efficiency of microbial removal from fresh vegetables while reducing the use of chemicals in the washing process. The study employed a prototype plasma water generator, with the independent variables being the airflow rate (1, 2, 3, and 4 liters per minute) and the duration of vegetable exposure to plasma water (5, 10, and 15 minutes). Microbial analysis was conducted to assess the contamination levels of Escherichia coli and Bacillus subtilis. The results revealed that plasma technology was more effective in reducing Bacillus subtilis contamination than Escherichia coli. This study highlights the potential of plasma technology for application in the food industry to enhance the safety and quality of fresh vegetables and food products.

Keywords: Escherichia coli, Bacillus subtilis, Plasma water generator

Food Science and Technology

FST-01

Application of Pulsed Electric Field and UV-C As a Non Thermal Pasteurization Integrated with Artificial Intelligence in Mango Juice Industry

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Abstract

Mango juice is a tropical fruit juice that is widely consumed in the world due to their flavor and nutritional value such as polyphenols and vitamin C. Currently, most commercial mango juices are produced using thermal treatments up to 80oC which cause changes in flavor, color, and degradation of vitamins and pigments during the process. To mitigate these issues, non thermal pasteurization techniques are utilized. Pulsed Electric Field (PEF) is one of the non thermal processing methods to extend their shelf life, preserving their physical characteristics and nutritional values. The physical characteristics of mango juices were detected then they were exposed to the PEF and enhanced by incorporating Ultraviolet C (UV-C) light at a dosage of 6 kJ/m2 within a continuous system. The combination of PEF and UV samples were observed to be highly stable when compared to thermal processed samples up to 90 days. The retention of vitamins was found to be higher in the combination-processed sample compared to those processed using thermal and PEF only. The pasteurization and PEF-UV combination presents a more energy-efficient and sustainable alternative to effectively inactivate any microorganisms, including spores.

Keywords: Artificial intelligence, Mango juice, Non-thermal pasteurization, Pulsed electric field, UV-C

FST-02

Microwave Processing: A Game-Changer for Sweet Potato Crackers

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Abstract

Microwave heating is a great alternative to replace traditional deep frying method in producing sweet potato crackers as it is more convenient, rapid, require lower cost and most importantly, results in healthier snacks. Sweet potato is chosen as the main ingredient because of the high nutritional content. In this study, cassava starch is used together with the sweet potato flour to increase the volume expansion of the final product. The best ratio of sweet potato flour to cassava starch and the most suitable drying time that would produce sweet potato crackers with the best quality attributes are investigated using response surface methodology (RSM). In the production process, the starches are mixed together with salt and hot water before being steamed and then cooled overnight at 4°C. Then, the cooled slab was cut into small pellet pieces and dried using a dehydrator. The dried pellets are then puffed using a domestic microwave oven. The result shows that the ratio of sweet potato flour to cassava starch which in the value of 1:1, 2:1 and 3:1 is highly significant (P=0) and negatively correlated with the volume expansion. Along with that, the drying time which varied from 5, 6 to 7 hours is highly significant and negatively correlated (P=0) with the moisture content. The optimization has successfully proved that the maximum volume expansion (504.96%) and minimum moisture content (10.94%) will be obtained when ratio of sweet potato flour to cassava starch is 1:1 and the drying time is 7 hours. The study can be used to improve the quality of microwaveable sweet potato crackers and fulfill the consumers demands.

Keywords: Microwave heating, Sweet potato crackers, Deep frying alternative, Sweet potato flour, Cassava starch, Volume expansion, Drying time, Response Surface Methodology (RSM), Moisture content, Optimization, Puffing

FST-03

CornVe'a (Vegan Corn Cheese)

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Abstract

This proposal presents the development of a vegan cheese, formulated as a health-conscious and inclusive alternative to traditional dairy-based cheese. CornVe'a (Vegan Corn Cheese) utilizes plant-based ingredients wherein the main ingredient is non-GMO sweet corn from Terengganu, Malaysia. By using corn, a locally available crop in many Southeast Asia regions, reducing reliance on imported ingredients aligned with the rising vegan trend where the plant-based food market is rapidly expanding, driven by increasing awareness of health, environmental, and ethical issues. This innovative product addresses the issue of halal and vegetarian cheese as dairy milk and rennet are widely used in the cheese industry. The cheese is lactose-free, making it suitable for those with lactose intolerance, while offering dietary fiber and stable shelf life. The production method incorporates corn juice and oat milk as a substitute for dairy milk, vegetable fats to replicate the creamy texture, and additional plant-based components such as tapioca starch, to achieve the desired structure and nutritional yeast for natural cheese flavor. This approach ensures cheese is not only shelf-stable but also free from animal-derived ingredients. To conclude, the resulting product provides an accessible cheese option for Muslim communities in Southeast Asia without halal concerns and promotes a vegetarian lifestyle. Nevertheless, the physicochemical and functional properties of shelf-stable cheese from corn milk still do not have enough studies. It can be of great interest to help improve the food and halal industry in Southeast Asia.

Keywords: Vegan cheese, corn, Plant-based ingredients, Health-conscious alternative, Food and halal industry, Southeast Asia

FST-04

Emping Emas (Golden Corn Crunch)

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Abstract

Emping Emas (Golden Corn Crunch) is the combination between classic goodness of tempeh and the appeal of non-GMO local Terengganu sweet corn, creating a unique treat that uplifts traditional snacks. This marks the first ever introduction of corn into tempeh. It is a traditional snack that is made by combining local recipes with modern processing technology, in a controlled condition to achieve the highest level of consistency and quality while upholding the authentic taste. Emping Emas is a nutrient-dense, plant-based snack that contains a good source of dietary fibre from corn and natural protein from soybeans. The fibre content serves as a prebiotic to support healthy gut flora and improve digestive health. Corn tempeh ingredients are selected and undergo minimal processing to preserve their natural qualities, avoiding artificial flavors, preservatives, and added sugars. This aligns with the clean label trend, which emphasizes transparency and simplicity in food products, making it a healthy and satisfying snacking option. Additionally, corn tempeh is high in fibre, providing benefits such as enhanced satiety and digestive support. This positions the product as a health-conscious alternative to traditional snacks. It is a nutritious snack option that delivers all the benefits of a fiber-rich diet in a delicious and convenient package. Using sweet corn as a key ingredient in this novel product can contribute to the country's economy by fully utilizing locally sourced resources. The availability of this raw material allows for commercialization at competitive prices, making the product affordable for a broad consumer base. Corn is a major crop in many parts of Southeast Asia, although rice and other grains tend to dominate agricultural production.

Keywords: Tempeh, Sweet corn, Traditional snack, Nutrient-dense snack

FST-05

Bamboo Mushroom Infused Fragrant Tea Olive Beverage

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Abstract

This research presents the development of a unique functional beverage combining bamboo mushroom (Phallus indusiate) with fragrant tea olive (Osmanthus fragrans) infusion. Bamboo mushroom is a nutrient-rich edible fungus known for its health benefits, including antioxidants and immune-boosting properties, while tea olive contributes a delicate aroma and potential bioactive compounds. The infusion process was optimized to enhance flavor, aroma, and nutrient retention. Sensory evaluation revealed high consumer acceptability due to the harmonious blend of floral notes. Additionally, the beverage demonstrated potential antioxidant activity and nutritional value. This innovative drink caters to the growing demand for health-conscious, naturally enriched beverages.

Keywords: Bamboo mushroom, Beverage, Infusion, Fragrant tea olive

FST-06

Sustainable Plant-Based Meat Jerky Product

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Abstract

The development of a sustainable plant-based meat jerky product is an emerging area of interest in research and development. This product aligns with the increasing demand from health-conscious consumers and those choosing plant-based diets. Plant-based jerky offers a viable alternative to traditional dried meat, providing a similar texture and taste while offering nutritional benefits such as lower fat content and higher fiber. Additionally, the production of plant-based jerky adds value to agricultural raw materials, such as young jackfruit, yam bean, legumes and other plant sources, promoting sustainable agricultural practices. This innovation has the potential to diversify the food industry and boost exports, creating new economic opportunities while addressing environmental concerns. The research and development of plant-based jerky could revolutionize the snack food market by offering a healthier, more sustainable, and ethical alternative to conventional meat-based products.

Keywords: Plant-Based, Meat, Jerky product

Postharvest Technology

PHT-01

Comparison of Seed Drying Methods of Rice and Maize Seeds

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Abstract

The seed moisture content is an important factor in seed storability. Therefore, this study investigated the effects of different drying methods on seed quality of maize and rice seeds. The Completely Randomized Design (CRD) is used as the experimental design that consists of (1) Seed drying by air-dry dehumidifier machine, (2) Seed drying by drying beads and (3) Seed drying by silica gels. Then, seed moisture content was randomly tested using the high constant temperature oven method during drying all treatments at 0, 2, 4, 6, 8, 10 and 12 hours. The percentage of seed moisture content was recorded. After drying all treatments, the seeds were tested seed germination in laboratory condition. The study found that drying maize and rice seeds by silica gels have efficiency in drying seed like air dry dehumidifier machine. For drying beads method has decreased percentage seed moisture content lower than other methods. However, the drying bead method of maize and rice seeds had higher seed germination in laboratory conditions than drying by air-drying dehumidifier machine and drying by silica gels and they were significantly different from other treatments.

Keywords: Seed moisture content, Seed quality, Silica gel, Seed dryer machine

PHT-02

APPLE: Advanced Preservation and Packaging using Logistical Environment with Respiration Quotient (RQ)-based Dynamic Modified Atmosphere Carrier System

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Abstract

The storage and transportation of fruits and vegetables present challenges due to their limited shelf-life and susceptibility to quality deterioration during long-distance distribution. For global distribution optimization, dynamic systems are required to handle long transit times and fluctuating storage conditions. Conventional storage methods, such as regular refrigerators (cold storage) and Controlled Atmosphere Storage (CA storage), are often insufficiently adaptive to the specific needs of fruits and vegetables. Respiration Quotient (RQ)-based Dynamic Modified Atmosphere Carrier System (DMACS) is a portable system that creates optimal environmental conditions for fruits and vegetables. The system is deployed and configured into a transportable box, making it adaptable for a variety of distribution needs. RQ-Based DMACS operates by dynamically adjusting oxygen (O_2) and carbon dioxide (CO_2) levels within the storage environment, customized to the specific needs of fruits and vegetables. This device consists of a sensing layer equipped with O_2 and CO_2 sensors to monitor gas levels, with a microcontroller serving as the processing unit. If the gas levels exceed the threshold, the action layer activates to open the O_2 supply. By maintaining these optimal conditions, the system will decrease respiration process and thus metabolic activities, minimize spoilage, nutrient loss, and ensure consistent supply of fruits and vegetables.

Keywords: Fruit and vegetables, Supply chain, Shelf life, Portable storage

PHT-03

Utilization of Ethanol Vapors Inhibits In Vitro Development of Key Pathogen Causing Anthracnose and Stem-End-Rot in 'Nam Dok Mai' Mango

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Abstract

The main challenge in ripening and distributing Nam Dok Mai mangoes is the widespread occurrence of anthracnose, which is triggered by the fungi *Colletotrichum gloeosporioides* and *Lasiodiplodia theobromae*, leading to stem-end rot. Using vaporizers in packaging offers a safe method to prevent mold growth on food products. This study aimed to assess the effectiveness of vapors from ethanol solutions at concentrations of 0, 5, 10%, and 20%v/v in inhibiting the growth of both fungi in vitro, utilizing a constant gas flow-control-system. The growth diameter of the mycelium was observed on potato dextrose agar culture media maintained at 25°C, while the ethanol vapor concentrations in the system were monitored. The results revealed that vapors from a 20%v/v ethanol solution completely suppressed the growth of *C. gloeosporioides* during incubation. However, on day 7 with the same concentration, a slight growth of *L. theobromae* mycelium was observed.

Keywords: Ethanol vapors, Mango, Pathogen

PHT-04

Application of Thermal Imaging Technology for prediction maturity of Tongar Avocado Fruit (*Persea americana* Mill)

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Abstract

Tongar avocado is a superior fruit produced in West Pasaman district, West Sumatra province, Indonesia. This avocado has a yellow flesh color like butter, a savory and soft taste, and a reasonably large size. Determining the maturity of avocado fruit in specific cultivars is very difficult because the color of the fruit skin remains green when ripe, which is not followed by significant changes in its appearance. This study aims to predict the maturity level of Tongar avocados using thermal imaging. Avocado fruit at four levels of maturity (150 days, 180 days, 210 days, and 240 days after the flowering) were harvested, then stored at a temperature of 28-29 ℃ for 6 hours to standardize with the ambient temperature. The image was captured using a thermal camera at a distance of 25 cm. The images were processed using software created using the Matlab (R2018a) application. The output of the application created is the temperature value and the H, S, and I value of the avocado, which were used as input to predict the ripeness of the avocado fruit. The developed thermal imaging application could predict the ripeness of Tongar avocado fruit based on thermal imaging at various maturity stages.

Keywords: Tongar avocado, Thermal imaging, Maturity, Temperature, Image processing

PHT-05

Croppa AI: Integrated Chatbot for Defects and Spoilage Detection in Agri-Food Products Using TCS3200 and Hyperspectral Imaging

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Abstract

The agri-food industry is currently facing a growing need for innovative solutions to address challenges in quality control, waste reduction and profitability. Post-harvest agri-food products are often prone to rapid spoilage and visual defects, which not only reduce their market value but also cause significant financial losses for producers and distributors. Current quality control methods are usually labour-intensive and prone to human error, making it difficult to ensure consistent product quality. This research introduces Croppa AI, a sophisticated machine learning-based chatbot designed to automatically detect defects in post-harvest agri-food products and present quality insights in a simple, easily comprehensible format. Croppa AI facilitates the utilisation of data-driven decisions by farmers and industry stakeholders by integrating data from the TCS3200 colour sensor and hyperspectral imaging, thereby producing highly accurate quality assessments of agri-food products. The TCS3200 sensor captures specific colour wavelengths to identify surface-level defects and colour inconsistencies, while hyperspectral imaging provides deeper insights by capturing the full spectrum of light for each pixel, detecting internal signs of decay or nutrient deficiencies. These data sources are combined in Croppa AI using a robust, labelled dataset of diverse agri-food products at various price levels.

Keywords: Croppa AI, Hyperspectral imaging, Post-harvest, TCS3200

PHT-06

Effects of Hot Water Treatments and Calcium Chloride on the Quality of Fresh-cut Guava (Cv. Kimju)

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Abstract

Nowadays, ready-to-eat fresh fruits are growing in many countries. Post-harvest loss of ready-to-eat fruit are the deterioration events such as respiration, moisture loss, enzymatic activity especially microbial growth during storage. To extend the postharvest quality, the effect of hot water (HWD) on the quality of fresh-cut guava was investigated. Guava pieces were dipped in hot water at 45 and 55 °C for 4 and 8 min, respectively. Total plate counts and flesh firmness were evaluated. HWD (55 °C for 4) effectively reduced the decay incidence, however HWD at a longer time provided negative effects on flesh firmness loss. In the second experiment, fresh-cut guava (dipped in 55 °C for 4 min) was immersion in 0.5, 1.0 and 2% w/v calcium chloride ($CaCl_2$) for 3 min compared with control. All treatments were packed in polypropylene box and stored at 5 ±1 °C with 85–90% RH. All $CaCl_2$ concentration also maintained firmness, increased bound Ca levels, reduced microbial growth and improved sensory quality compared to control. Nevertheless, 2.0% $CaCl_2$ imparted a slight off-flavor to the cut guava, and therefore, lower $CaCl_2$ concentrations must be studied to avoid this off-flavor.

Keywords: Hot water dipping (HWD), Calcium chloride (CaCl2), Fresh-cut guava

Rubber Technology and Material Science

RBT-01

Anti-Corrosion Coating of Steel with Natural Rubber Latex

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Abstract

This research involves the preparation of epoxide natural rubber (ENR) latex used as an anti-corrosion coating agent. The ENR latex (54%mol epoxidation), prepared via the in-situ epoxidation using formic acid/hydrogen peroxide at 70ºC for 24 h, was blended with the synthesized ZnO nanoparticles (NPs) and phosphoric acid (PA), and then cast on a steel. The crystalline of ZnO NPs particles was a hexagonal structure confirmed by X-ray diffraction (XRD) pattern. Results showed that the added ZnO NPs significantly improved the anti-corrosion properties of low carbon steel whereas phosphate groups could enhance the adhesion between the coating film and substrate, and hence, its anti-corrosion properties. The phosphate functional group could anchor on the metal surface with covalent bonds which turned the hydrophilic groups into hydrophobic groups. Therefore, the PA acts as the crosslinking bridge between the ENR-ZP film and metal surface. The anti-corrosion film was able to protect steel from 37% hydrochloric acid, 48% sodium hydroxide and 10% of sodium chloride. The suitable condition of ENR-anticorrosion for acid-based resistance consisted of 0.5 phr of ZnO NPs and 1.0 phr of PA.

Keywords: Anti-corrosion coating agent, Epoxide natural rubber, ZnO nanoparticles

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