MINGGU PENYELIDIKAN DAN INOVASI SAINS DAN TEKNOLOGI

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MINGGU PENYELIDIKAN DAN INOVASI SAINS DAN TEKNOLOGI 2022

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PREFACE

Welcome to our 1st ***Minggu Penyelidikan dan Inovasi Sains dan Teknologi 2022 (MPIST 2022).*** Thank you to all the participants who joined our event. The MPIST 2022 event includes two sub-programs: ***Kolokium Siswazah Sains dan Teknologi 2022*** **(KoSiST 2022)**/ Science and Technology Graduate Colloquium 2022, and the FST Innovation Competition (FIC). MPIST 2022 is organized by the Faculty of Science and Technology and the theme of this year's event is "**Synergizing Innovation and Research Through Science and Technology**,"

This event is a platform initiated to encourage postgraduate as well as undergraduate students to share their research knowledge and product innovation with the audience. It also functions as a platform to allow students to sharpen their communication and presentation skills. There are 10 papers under Pure and Applies Chemistry; Food Biotechnology; Health Science and Technology; and Theoretical and Applied Computes themes were presented during the colloquium. Newly develop product were also virtually exhibited. All presented paperwork and innovations are publish as E-Proceedings Minggu Penyelidikan dan Innovasi Sains dan Teknologi 2022 which can be obtained through our Faculty of Technology (FST) website, https://fst.usim.edu.my/mpist/.

MPIST 2022 Committee

SPEECH OF THE PROGRAMME DIRECTOR

Assalamu'alaikum warahmatullah wabarakatuh,

Praise be to the Almighty Allah (SWT) for blessing us with the opportunity to organize the very first ***Minggu Penyelidikan dan Inovasi Sains dan Teknologi*** **2022 (MPIST 2022)**. The MPIST 2022 event includes two sub-programs: ***Kolokium Siswazah Sains dan Teknologi 2022*** **(KoSiST 2022)**/ Science and Technology Graduate Colloquium 2022, and the FST Innovation Competition (FIC). With the theme "**Synergizing Innovation and Research Through Science and Technology**," MPIST 2022 is one of the knowledge-sharing platforms, views, and discussions to strengthen efforts and strategies in research and innovation within and outside the Faculty of Science and Technology, Universiti Sains Islam Malaysia.

On behalf of the MPIST 2022 committee, we would want to take this opportunity to welcome and thank all invited speakers, presenters, and attendees for attending this educational event. After two years of online seminars, the game has finally returned to physical events with a new norm. To ensure the success of this educational event, commitment, and collaboration from a variety of stakeholders are required. KoSiST 2022 will provide chances and space for all speakers and attendees to discuss strategy, enhance their communication and scientific writing skills, and attain their full potential. The FST Innovation Competition (FIC) also recognizes the innovation and research of our graduate students and faculty members. Congratulations to all presenters.

Well done to the MPIST committee members, who, on top of their individual responsibilities, collaborated and gave their all to make MPIST 2022 come to fruition. May all efforts in making MPIST 2022 a success be blessed by The Almighty Allah (SWT). *Jazakumullahu khayran kathira*.

Dr. Syamila Mansor,
Director, ***Kolokium Siswazah Sains dan Teknologi 2022*** **(KoSiST 2022)**
Minggu Penyelidikan dan Inovasi Sains dan Teknologi **2022 (MPIST 2022)**

Dr Azira Khalil,
Director, FST Innovation Competition 2022 **(FIC 2022)**
Minggu Penyelidikan dan Inovasi Sains dan Teknologi **2022 (MPIST 2022)**

SPEECH OF THE DEAN OF FST, USIM

Assalamu'alaikum wbrt and greetings,

On behalf of the Faculty of Science and Technology (FST), Universiti Sains Islam Malaysia (USIM), it gives me great pleasure to warmly welcome you to the Science and Technology Research and Innovation Week (MPIST 2022). MPIST 2022 includes two sub-programs, the 5th Science and Technology Graduate Colloquium (KoSiST 2022) and the FST Innovation Competition (FIC). Academicians, industry professionals, post-doctorates, post-graduates, researchers, scientists, and students are welcome to attend this colloquium.

The theme for this year's colloquium is "**Synergizing Innovation and Research through Science and Technology**". The COVID-19 pandemic has taught us a valuable lesson in emphasizing the importance of knowledge, research, and innovation in addressing global issues. This colloquium will cover a wide range of topics, including Food Biotechnology, Health Science and Technology, Pure and Applied Chemistry, Pure and Applied Mathematics, Pure and Applied Physics, as well as Theoretical and Applied Computers, which aligns with the theme. Moreover, the colloquium is packed with current topics and innovative science, including time for networking, mentoring, and socializing. This colloquium also intends to demonstrate the university's commitment to science and technology as well as the spirit of knowledge-sharing. We hope you enjoy our comprehensive program, which includes keynote speakers, oral presentations, and innovation videos. Please take advantage of this opportunity to boost knowledge sharing and networking among delegates. Last but not the least, I would like to thank the Organizing Committee for their commitment, dedication, and continuous support. A special request to the delegates who came to share their research, make yourself at home and please enjoy the colloquium.

Prof. Dr. Rosalina Abdul Salam
Dean, Faculty of Science & Technology, USIM
Advisor, ***Minggu Penyelidikan dan Inovasi Sains dan Teknologi*** **2022 (MPIST 2022)**

INVITED SPEAKER I

DR. MUHAMAD ARIF MOHAMAD JAMALI obtained his Ph.D. in Biophysics under the Leading Graduate Schools program by Japan's Ministry of Education, Culture, Sports, Science, and Technology (MEXT). He is based in Biometal Laboratory, RIKEN Spring8, Japan, and has been supervised by Prof Yoshitsugu Shiro. During his journey toward his Ph.D. from 2016 to 2019, he works on the CryoEM, X-ray crystallography, and kinetic study of Nitric oxide reductase from Neisseria meningitidis. In early 2019, he was awarded the Young Scientist Abroad Challenge fellowship from MEXT, and he went to Electron-Bioimagine Center (eBIC) in Oxford for almost a year. During this fellowship training, he was trained in CryoEM handling and single particle analysis data processing. At the end of his Ph.D., he was able to elucidate a few structures of nitric oxide reductase from N. meningitis as this membrane-bound enzyme plays a crucial function for N. Meningitis to invade the human immune response during infection. Right after his Ph.D., he joined the department of chemistry, at the national university of Singapore as a research fellow. He mainly works on the outer layer membrane protein in gram-negative bacteria, such as the OmpC-MIaA complex and the ToIQRA protein complex. Then, starting in November 2021, he joined the faculty of science and technology at USIM. Now he is interested in understanding protein chemistry in gram-negative bacteria by using the computational biophysical method.

INVITED SPEAKER II

DR. NORHIDAYAH AZMAN is a Senior Lecturer at the Faculty of Science and Technology, USIM. Her specialization is in social media, social networks, information retrieval, and Big Data analytics. Her Ph.D. work from the University of Southampton, UK, centered on investigating influence via dark retweets and information propagation via microblogging platforms such as Twitter. She has appeared on TV *Alhijrah* addressing the Effects of the Internet on Generation Y. She has also won Gold Awards at the International Conference and Exposition on Inventions by Institutions of Higher Learning (PECIPTA 2022), the Malaysia Technology Expo (MTE 2022), and USIM Innovation Bank Challenge (IBC'22) for the 'i-Status Hadis Word Add-in' project. She was editor-in-chief of the LEADER Magazine, published by the Malaysian Higher Education Leadership Academy (AKEPT) and USIM, with circulation involving ministers, vice-chancellors, rectors, and deans in Malaysia and abroad. She co-chaired the Interdisciplinary Coups and Calamities workshop co-located with the Web Science 2014 conference in Bloomington, Indiana, US. Aside from computer science, she actively coaches chess to school kids and university students.

PLATFORM A (PURE AND APPLIED CHEMISTRY)

ACID AND ENZYMATIC HYDROLYSIS OF CELLULOSE FROM WASTE PAPER TO GLUCOSE

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***Keywords**: Acid hydrolysis, enzymatic hydrolysis, waste paper, glucose concentration, hydrolysis efficiency*

ABSTRACT

This paper studied on the production of glucose, a platform chemical, obtained from the hydrolysis of cellulose in waste paper catalysed either via acid or enzyme. Waste paper was utilized in the study as it was abundance, does not compete with food source, high in cellulose content and low in both hemicellulose and lignin content. The formation of glucose was achieved with the breakage of β-1,4-glycosidic linkages that exist between the oxygen and the carbon atoms, of a pair of glucose unit in a cellulose strand. The glucose concentration in the acid hydrolysis was 0.0168 mol/L representing 76% of cellulose conversion to glucose. The glucose concentration in the enzymatic hydrolysis was 0.0210 mol/L representing 72% of cellulose conversion to glucose. Taking into account on the reaction condition and time, by-product production as well as the toxicity issues, this paper confirms the fact that enzymatic hydrolysis is far more advantageous compared to acid hydrolysis process in the production of glucose from cellulose in waste paper.

INTRODUCTION

It is interesting to note that glucose, a base compound for many high-value goods. Gluconic acid, lactic acid, ethanol, ethylene glycol, sorbitol, and furfural are just a few of the high-value chemicals that may be produced from it. The main driver of the rising interest in the hydrolysis of waste paper into glucose is cellulose, which makes up approximately 50-60% of waste paper's component [1]. Acid hydrolysis of office waste paper [2-3], used paper towel [4] has resulted in high glucose concentration, with the cellulose conversion of 70-100%. However, acid hydrolysis is an outdated technique in which the unreacted acid in the process is typically not recycled; instead, it is only neutralised, creating significant amounts of salt, which makes this procedure problematic from an economic and environmental standpoint [5]. The hydrolysis industry has switched over in recent decades from employing acid to enzyme in the hydrolysis process. Minimal toxicity, low corrosion, no inhibiting by-products, and little environmental harm are all characteristics of enzyme hydrolysis [6]. Enzymatic hydrolysis of used office paper and newspaper [7-8] also has resulted in high glucose concentration, with the cellulose conversion of 80-95%. Previous research has shown that these two hydrolysis techniques can yield up to 100% of glucose yield. A few studies have compared the effectiveness of these two hydrolysis methods, nevertheless. In this study, we aim to compare the glucose production as well as the advantages and disadvantages of two hydrolysis methods—acid- and enzyme-catalysed.

METHODOLOGY

Acid hydrolysis

Shredded waste paper (300mg) was loaded into a pressure tube, followed by the addition of 3mL 72wt% of sulphuric acid (H_2SO_4). After stirring using a glass rod at room temperature for one minute, the tube then was incubated in a water bath, allowing the mixture to react at 30°C for 1h. During the incubation period, the mixture was stirred using the glass rod for every 10 min interval without removing the tube from the water bath. When the incubation period has elapsed, the mixture was diluted to 4% concentration by adding distilled water (84mL). The tube was sealed tightly, inverted several times, and later autoclaved at 121°C for 1h. Next, the resultant mixture was filtered and the filtrate was neutralised by adding calcium carbonate ($CaCO_3$) until the pH reached 5-6. The mixture was allowed to stand, separating the solid and the liquid fractions. Then the liquid fraction was filtered by polytetrafluoroethylene (PTFE) filter, and later be quantified by glucometer.

Enzymatic hydrolysis

Into a 50mL-falcon tube, the following substances were added: shredded waste paper (100mg), 0.1 M of citrate buffer (pH4.7, 5 mL), tetracycline (80 μL) and free cellulase enzyme. The volume of the sample then was increased to 10mL by adding distilled water. Next, the tube was placed in an incubator at 50°C with shaking at 150 rpm for 72h. When the incubation time has elapsed, the sample was immediately cooled in an ice bath and hydrolysate was filtered through a syringe filter. Finally, the filtrate was quantified by glucometer.

RESULTS AND DISCUSSION

The results of the hydrolysis of cellulose derived from waste paper to produce glucose when either an acid or an enzyme is used are shown in Table 1. Enzymatic hydrolysis is shown to have more glucose concentration in its mixture (0.0210mol/L) when tested with glucometer compared to that in acid hydrolysis (0.0168mol/L). However, glucose is calculated to be 40.35% and 37.77% in the hydrolysate of acid and enzymatic hydrolysis, respectively, which shows that acid hydrolysis has yielded more glucose. Nevertheless, both hydrolysis process produces similar efficiency, with acid hydrolysis of 76% and enzymatic hydrolysis of 72% (Figure 1). Thus, it can be inferred that both processes in this study successfully converted cellulose to glucose.

Table 1. Amount of glucose from glucometer testing

	Acid hydrolysis	Enzymatic hydrolysis
Concentration (mol/L)	0.0168	0.0210

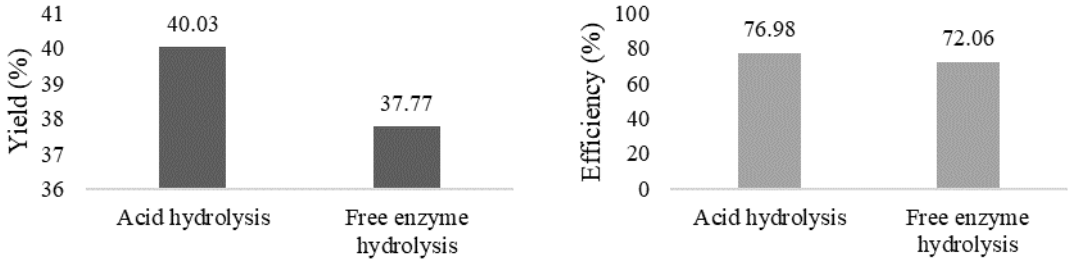

Figure 1. Glucose yield (left) and hydrolysis efficiency (right) in acid and enzymatic hydrolysis

Waste paper has been effectively hydrolysed by acid and enzymes to produce glucose with high hydrolysis efficiencies of 76% and 72%, respectively. Additionally, acid hydrolysis takes only a few hours (1-2h), whereas enzymatic hydrolysis takes at least 72 hours. However, the acid hydrolysis process has the drawbacks of being destructive to equipment and hazardous due to the usage of diluted acid (30–70% concentration) [9-10]. When performing enzymatic hydrolysis, maintaining a moderate temperature and atmosphere is not only necessary for the enzymes to function at their best, but it also has the added benefits of being safer and more environmentally friendly. Acid hydrolysis is also carried out at a high temperature (121°C). As a result, the cost of using energy might increase as well.

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SYNTHESIS AND ANALYSIS OF WEIGHT LOSS OF CMC CARBON AEROGEL

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***Keywords**: Carboxymethyl cellulose, CMC carbon aerogel, mass loss, concentration, temperature.*

ABSTRACT

Carboxymethyl cellulose (CMC) is a derivative of cellulose that shares most of its chemical and physical properties while also Possessing solubility in water and most organic solvents, because of these unique properties CMC was used in this research to produce CMC aerogel at different concentrations of CMC (1%, 2%, 3%, 4%), the prepared CMC was then carbonised at different temperatures (300 °C, 400 °C, 500 °C, 600 °C, 700 °C and 800 °C) and for different durations of 1 hour and 2 hours to produce CMC carbon aerogel and to study the effect of different experimental parameters on the weight loss in the carbonised CMC aerogel. At low to mid-range temperatures of carbonisation we can observe a decreasing pattern in mass loss as the concentration is increased and this due to the physical properties of CMC aerogel while at higher temperatures it is observed that higher concentration of CMC yielded a higher weigh loss due to the completion of the carbonisation and decomposition of CMC aerogel. The different experimental parameters had a clear effect on the weight loss of the prepared CMC carbon aerogel.

INTRODUCTION

Cellulose is one of the most common organic materials that are found in nature, it is typically found in plants (Brigham 2017), it has been used in many industries due to its availability and eco-friendly nature, but its insolubility in water and most organic solvents has limited the universality in its applications. This insolubility is due to the amphiphilic molecular chains in cellulose as well as the high crystallinity which it possesses (Long et al. 2019). Due the limitations of cellulose the need of a substitute has arisen. Carboxymethyl cellulose is derivative of cellulose that is just as readily available in nature while also being soluble in water and most organic solvents. Due to the eco-friendly nature of CMC as well as its renewability it has been used in many industries such as: medical industries and agricultural industries (Lin et al. 2015). It is because of the factors mentioned above, CMC was chosen as the starting material in this research.

METHODOLOGY

CMC aerogel was prepared at different concentration by mixing different amounts of CMC (5g, 10g, 15g, 20g) with 10g of D-(+)-gluconic acid-lactone and 2.5g of Glycerol and dissolving the mixture in 500mL of deionized water. After a vigorous stirring the solution underwent an ultrasonic bath for 4 hours after which it was kept for 72 hours for the gelation to happen and for the cross-linking process to occur. The solution was then frozen for 24 hours and placed in a freeze dryer for 72 hours. At this point CMC aerogel was produced which was carbonised at different temperatures (300 °C, 400 °C, 500 °C, 600 °C, 700 °C and 800 °C) and different durations (1 hour and 2hours) to produce CMC carbon

aerogel and to study the effects of different experimental parameters on the weight loss of the CMC aerogel.

RESULTS AND DISCUSSION

The prepared CMC aerogel had different physical properties and characteristics based on the concentration of the CMC. Samples with low concentration of CMC had a highly porous structure resembling interconnected strings, while having high elasticity. On the other hand, samples with high concentrations of CMC were solid and brittle with less porous structure. After the carbonisation all the samples produced CMC carbon aerogel which was solid and had a brittle consistency.

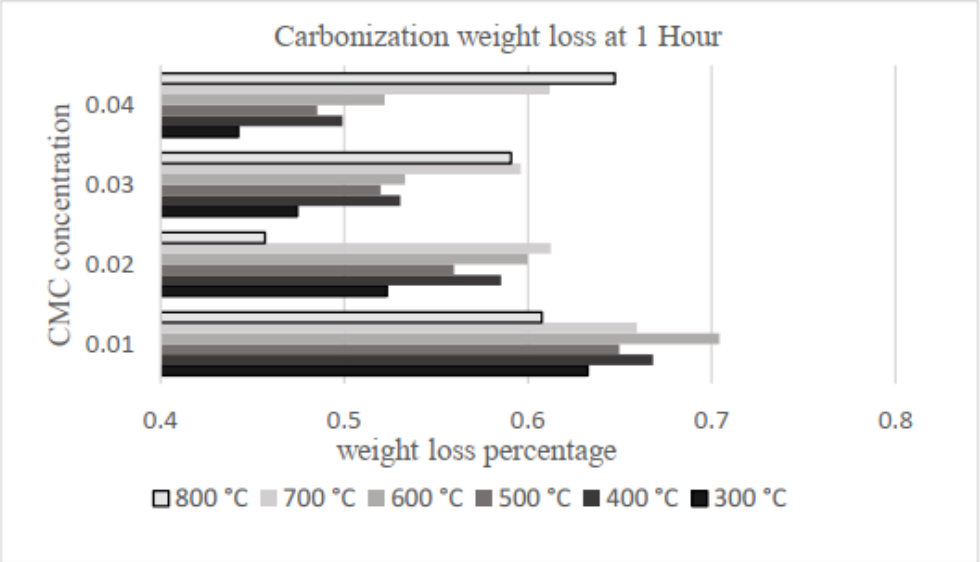

Figure 1. Carbonization weight loss of CMC carbon aerogel at different temperatures and various concentrations of CMC at 1 hour

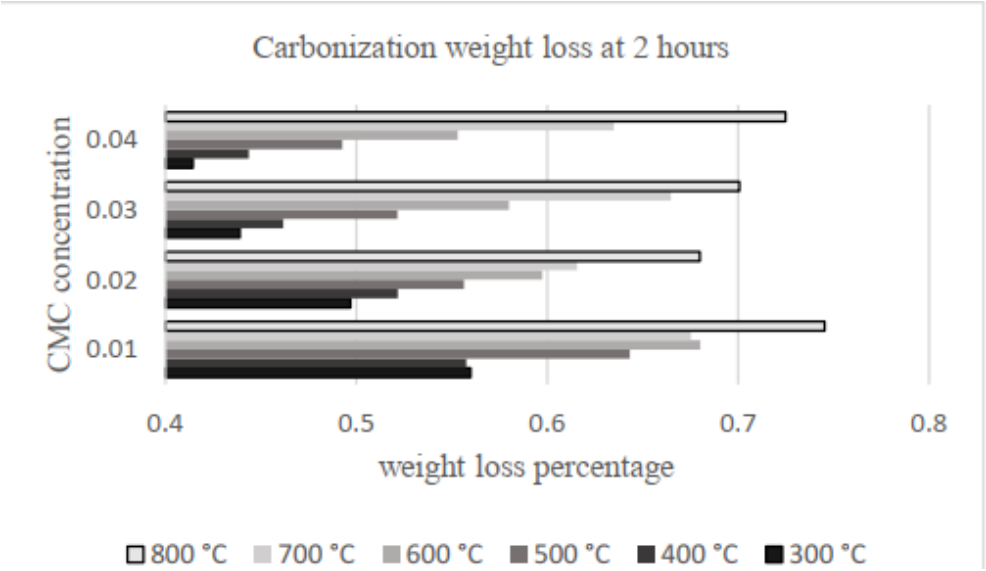

Figure 2. Carbonization weight loss of CMC carbon aerogel at different temperatures and various concentrations of CMC at 2 hours

From the bar graphs above we can observe that the patterns of weight loss for 1 hour and 2 hours are similar but have varying severities. At temperature ranging from 300 °C to 600 °C we can observe a decrease in mass loss as the concentration is increased and this is due to the physical properties of the CMC aerogel that have higher surface area at lower concentration and this leads to higher weight loss (Meng et al. 2015). On the other hand, higher temperatures of carbonisation (700 °C, 800 °C) had a higher weight loss at higher concentrations of CMC and that is due to the complete decompositions of the CMC aerogel into CMC carbon aerogel (Reuß and Ratke 2008).

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PLATFORM B (FOOD BIOTECHNOLOGY)

COMPARISON OF HALAL FATS AND OILS WITH LARD USING FTIR AND CHEMOMETRICS

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Keywords: *Halal, lard, FTIR, chemometrics.*

ABSTRACT

Fats and oil adulteration in the food industry is a recurring problem that negatively impacts the quality and safety of the food product. Efforts to ensure fats and oil authentication has involved investigating different analytical methods of adulteration detection. Fourier transform infrared spectroscopy (FTIR) is reported to be the favorable method when coupled with chemometrics. Focusing on halal food as a compulsory dietary requirement for Muslims, concerns regarding halal authenticity of fats and oil have been highlighted. This study aimed to compare halal fats with lard. The objective of this study was to identify the lipid profile of lard using FTIR analysis, compare the lipid profile of lard with halal fats and oil and to determine the differences of lipid profile between halal fats and oil and lard through chemometric analysis. The FTIR analysis was successful in obtaining a lard profile. FTIR data was then analyze through principal component analysis (PCA). Clear separations on the score plot between the different fats and oil samples. This study showed that lipid profile is highly similar to halal fats and oils but can be differentiated through chemometrics. PCA is a suitable tool to support FTIR analysis in differentiating fats and oils.

INTRODUCTION

In the food industry, fats and oil are highly vulnerable to adulteration and for decades this have been a recurring problem [1]. It is intolerable in the food industry because it compromises the quality of the product and poses as a food safety issue where it can be detrimental to health [2] or cause allergic reactions [3]. Adulteration of food product with non-halal ingredients like the addition of lard to butter could also lead to mistrust from the Muslim community [4]. To detect the adulteration of fats and oils, several analytical methods have been identified [5]-[7]. Gas chromatography (GC) and high-performance liquid chromatography (HPLC) have been used to authenticate cocoa butter [8], olive oil [9], argan oil, soya bean oil, and sunflower oil [10]. Chromatographic methods require highly skilled personnel, tedious sample pre-treatments and preparation, and demands long processing time [11]. Fourier transform infrared spectroscopy (FTIR) is the most common method used to investigate fats and oil authentication. Studies employing FTIR have determined adulteration of cod-liver oil with lard [12], adulteration of olive oil [13], and adulteration of cold press sesame oil [14]. This method is rapid

and relatively easy to conduct with minimal sample preparation. Data obtained from FTIR are usually insufficient without further analysis [15]. With regards to halal assurance, halal products must be free of non-halal ingredients. Among others, butter, sunflower oil, canola oil, olive oil, coconut oil, and mustard oil are vulnerable to non-halal adulterations due to the high compositional similarities [16]. Deliberate addition of lard in butter and other plant oils that are subsequently used for bread products have been reported [17]-[18]. Although literature is available on detection of lard adulteration in fats and oil, information on differences in breed is still lacking for reference. The aim of this study is to compare halal fats and with lard. The objective of this study is to identify the lipid profile of lard using FTIR analysis, compare the lipid profile of lard with halal fats and oil, and to determine the differences of lipid profile between halal fats and oil and lard through chemometric analysis.

METHODOLOGY

Samples and preparation

Pigs were identified and purchased from MyBarn, Malaysia (https://www.mybarn.com.my/). The breeds purchased were Berkshire (black pork), Iberico (black pork), Olive fed (white pork), and White local (white pork). Both the Berkshire (B) and White local (W) are pork raised in Malaysia while Iberico (I) and Olive (O) are pork imported from Spain. Pure butter (PB), olive oil (OO), palm oil (PO), and sunflower oil (SO) were purchased from the local supermarket as halal fats and oil samples. All lipid samples from the fats and oils were extracted using the Folch method [19]. Briefly, 20 mL of chloroform-methanol mixture (2:1 v/v) is used to dissolve 1 g of fat sample. The mixture is periodically stirred at room temperature for 15 min before the mixture is filtered through filter paper. The mixture is then washed with 4 mL of 0.9% sodium chloride (NaCl), vortexed for 10 sec and left to stand at room temperature for 20 min. The bottom layer containing the extracted lipids were removed and stored in glass vials with Teflon lined caps. The extracted lipids were stored at -18 °C prior to analysis.

Ftir spectroscopy and chemometric analysis

FTIR analysis was carried out using an attenuated total reflectance (ATR-FTIR) (Perkin Elmer, MA, USA). Samples were scanned in the range of 4,000 to 650 cm^{-1} with a resolution of 4 cm^{-1} and a total accumulation of 32 scans. Prior to sample analysis, background scans of surrounding air were acquired. The platform was also cleaned using methanol to avoid contamination. FTIR spectra are collected and recorded as transmittance percentage (T%). The multivariate data from the FTIR analysis were investigated using chemometric, specifically PCA analysis. Data were managed in Microsoft Excel before being imported into the Unscrambler 10.3 X software (CAMO, USA) for chemometric analysis. Suitable data pre-processing was applied prior to PCA analysis.

RESULTS AND DISCUSSIONS

Lipid profile of lard

From the FTIR spectrum, peaks at specific wavenumbers correlate to specific functional groups. Based on the data obtained, FTIR spectrum of 100% lard appears in the range of 4,000 to 650 cm^{-1}. All the peaks identified in the study collectively shows that the sample is animal fat metabolite. Wavenumbers where the peaks forms that correlates to the functional groups found in the lard samples were identified and were compared to other studies where similar peaks were found to show that this is a lipid profile for lard [20]-[21].

Lipid profile comparison of halal fats and oils with lard from different pig breeds

Lard samples from the different breed of pigs Berkshire (B), Iberico (I), Olive (O), and White (W) and fats and oils (pure butter (PB), olive oil (OO), palm oil (PO), and sunflower oil (SO)) were analyzed with FTIR. The spectrum obtained for lard samples B, I, O, and W combined with the spectrum obtained for OO, PB, PO, and SO. Triglycerides are the major constituents of fats and oils, and it is observed in all samples making it difficult to distinguish individual spectrum. The shared peaks from the analysis are a result of the same functional groups present in the samples. Other studies investigating fats and oil adulteration have also reported the difficulty in differentiating samples through FTIR spectrum by visual analysis alone [22]-[24].

Chemometric analysis of halal and non-halal fats and oils

A principal component analysis (PCA) was carried out with the objective of determining whether lipids from different pig breeds are distinguishable between each other and between other fats and oil. Based on the analysis, there is clear grouping of lard with other fat and oils. Similarly, other studies have reported that it is possible to differentiate between animal fats and vegetable oils through spectroscopy followed by PCA analysis [25]-[27]. The breed of the pig has significant influence on the meat's quality [28] and the genotype that affected the quality of the meat was successfully differentiated through a PCA analysis in a separate study [29]. The differences in types of lard and other types of fats could suggest differences in the lipid metabolite in each samples.

CONCLUSION

The FTIR spectroscopy analysis were able to qualitatively identify lard based on the spectrum obtained. The peaks identified in the spectrum corresponds to the functional group present in the lipid samples. By comparison to past reports, it was confirmed that the spectrum belongs to animal fat lard. The FTIR spectrum of the lard in comparison to other halal fats and oil specifically olive oil, pure butter, palm oil, and sunflower oil was difficult to differentiate. The samples were almost non-distinguishable due to the high similarity of triglycerides present in fats and oil. Further analysis through PCA proved that there is visible cluster pattern that could group the different samples. Different types of fats and oil were seem clustered together. The sample pure butter is observed to stand alone while the oils are all separated but generally in the same region of the score plot. The PCA score plot emphasizes that chemometric analysis is important in supporting the FTIR analysis to differentiate between the halal fat and oil samples with the lard samples.

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POTENTIAL USE OF UNDERUTILISED MUSHROOM STEMS IN MEAT PRODUCTS: A REVIEW

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Keywords: *Mushroom waste, mushroom as meat alternative, plant-based alternative, underutilised mushroom stems*

ABSTRACT

Fast foods consumption has been associated with an increase in chronic diseases. Consumers' increased awareness of the possible links between nutrition and health has led to major dietary changes toward healthier food options. Furthermore, rising meat prices, veganisms, and concerns about animal suffering as well as sustainability issues have driven market trends toward plant-based alternatives. Mushrooms are regarded as one of the healthier ingredients that believed to be associated to their nutritive, bioactive, and therapeutic values. In fact, the fibrous structure of mushroom mimics to meat texture as well as possesses an umami flavour. Asian countries generate the highest percentage of overall mushroom production (74.64%). The application of mushrooms, however, is limited to the fruiting bodies rather than the stems. The stems are often discarded as food waste due to their tough texture. Researchers have begun to use edible mushroom waste and their by-products to create value-added products in a variety of sectors such as the food industry, owing to their nutritional values, and contributions to the circular economy and environmental protection. The primary intent of this review is to discuss the potential of underutilised mushroom stems in meat products.

INTRODUCTION

Demanding of meat product has globally rising steadily over the years. In fact, meat has been considered a luxury in the past and become a staple which can be found in almost all restaurants and kitchens across the world. The most popular type of processed meat is from poultry, followed by red meat, which includes pork and beef, accounting for 38% and 33% of the global market, respectively [1]. Meat products are often consumed due to their sensory characteristics and high nutritional content of proteins, minerals (iron, selenium, zinc) and vitamins (primarily B_6 and B_{12}) [2]. However, they are deficient in calcium, dietary fibre, and vitamin C [3].

The demand for convenience food is increasing rapidly as it provides quick meal options in today's chaotic world. For example, the fast-food business is witnessing significant growth with a wide variety of food choices, especially in urban areas [4]. In fact, in 1951, the 'fast food' terminology was introduced by Merriam Webster. At that time, the term is normally referred to food that can be prepared and served very quickly such as hamburgers and pizzas. However, consumption of fast food is greatly associated with severe health problems such as diabetes, obesity, hypercholesterolemia, hypertension, and cardiovascular disease that are believed to be related to the excessive amounts of energy and fat and low nutritional content of fat fast [5].

In recent years, the awareness of nutrition and health has led to dietary major changes toward healthier food choices [3]. In addition, rising meat prices, emergence of veganism, [6] and rising consumer concerns about animal suffering and sustainability issues, particularly greenhouse gas

emissions from animal protein production, have shifted consumer preference toward meat alternatives [7] such as soybeans, legumes, wheat, oil seeds and mushrooms. Moreover, the plant-based ingredients as meat alternative are cheaper than meat and could offer nutritional and health benefits equivalent as meat [6].

In general, mushrooms are regarded as one of the healthier ingredients due to their bioactive, nutritive, and therapeutic values. The fibrous structure of mushrooms mimics the texture of meat and possess an umami flavour [3] which is believed to be associated with sulphur-containing amino acids [8]. Meat analogous also known as meat substitute, meat alternative, faux meat, mock meat or imitation meat is defined as food that is structurally similar to meat but differs in composition. It demonstrates the aesthetic qualities of certain types of meat, mainly the texture, flavour and appearance as well as the chemical properties [6].

The cultivation of mushrooms is rising due to the current surge in health foods, with China being the highest mushroom producer. There are 30 nations that generate more than 10,000 tonnes of mushroom annually and 43 nations that produce less than 10,000 tonnes of mushrooms with the total production of the world is nearly 10.2 million tonnes [9]. The application of mushrooms, however, is limited to the fruiting bodies rather than the stems which contain high polysaccharide content. The stems are often discarded due to their tough texture, which leads to problems in agro-industrial waste management [8]. These leftovers mainly go to landfills or are used as compost [10].

In China, the mushroom business generated over 100,000 tonnes of stems per year, and it was assumed that the volume was similarly higher in other nations [11]. Researchers have begun to use edible mushroom waste and by-products to create value-added products in a variety of sectors such as the food industry, owing to their nutritional values and contributions to the circular economy and environmental protection [12]. The primary intent of this review is to discuss the potential use of underutilised mushroom stems in meat products.

Background of mushroom

A mushroom is a fleshy, spore-bearing fruiting body of a fungus that is recognised by a stem, cap and gills [13]. Mushrooms have been consumed since antiquity and recognised by many civilizations, including the Greeks, Romans, and Chinese [14] for their organoleptic properties, nutritional content, cultivating conditions, and healing properties [15]. Mushrooms were widely used for culinary purposes by the upper class during the previous era. Mushrooms have a peculiarly pleasant savoury taste which is known as umami due to the presence of sodium salts of free amino acids such as glutamic and aspartic amino acids and 50-nucleotides, which makes them a popular choice in food. Currently, mushrooms are consumed in households all over the world as they possess a unique texture and desirable taste [16].

Mushrooms can be classified into three categories; edible, medicinal and wild. It is believed that there are at least 12,000 mushroom species worldwide, with around 2000 of them ideal for edible and/or medicinal use [3]. Globally, Asian countries generate the highest percentage of overall mushroom production (74.64%) [8]. China is reported to be the world's largest mushroom producer along with the United States, Italy, The Netherlands and Poland. The most cultivated edible mushroom species are *Pleurotus ostreatus, Lentinula edodes, Agaricus bisporus*, *Flammulina velutipes* and *Auricularia auricular*. Meanwhile, *Ganoderma lucidum, Cordyceps sinensis* and *Poria cocos* are the most harvested medicinal mushrooms [15]. The most important factors influencing the production of grown edible mushrooms are temperature, humidity, fresh air, and compact material [3].

Nutritional properties of mushroom

Mushrooms are known for their nutritional richness and have been used in various products such as bread, burgers, muffins, pasta, snacks [17], ketchup, soup, jam, noodles, sponge cake, cookies and biscuits [12]. Approximately 5 kg of mushrooms are consumed per person in a year and this number is projected to rise due to the consumer awareness towards healthy diets [17]. Mushrooms are a high-quality protein source as they contain all nine amino acids essential for humans [3]. Mushrooms have about four times the protein content of tomatoes and carrots, six times that of oranges, and twelve times that of apples [3]. However, the amount of crude protein of mushrooms is mainly differ and affected by development stage and species [12]. Mushrooms are high in indigestible carbohydrates. They have a low glycemic index and high mannitol content making them apt for diabetic patient. Moreover, mushrooms are an excellent source of polysaccharides (α-glucan, β-glucan chitin, mannans, galactans and xylans), minerals (copper, iron, manganese, zinc, phosphorus and potassium), vitamins (B_1, B_2, B_{12}, C, D, E, folate and niacin) and unsaturated fatty acids primarily linoleic acid [3].
Mushrooms are cholesterol-free, gluten-free, and content low amount of sodium [18]. Mushrooms, both cap and stem, are high in dietary fibre due to the presence of non-starch polysaccharides which may help in preventing hypertension and hypercholesterolemia, as well as being beneficial in weight control [3]. Mushrooms are also a rich source of bioactive compounds such as phenolic and flavonoid that could be vital to human health in lowering the risk of diseases such as hypertension, stroke and cancer. In addition, mushroom act as an immune system enhancer, antibacterial and cholesterol-lowering agents. Consumers consume almost 5 kg of mushrooms per person per year on average, and this amount is projected to due to consumer awareness on healthy diet [17].

Use of mushroom stems in meat products

Consumers ingest meat products for their sensory properties and essential nutritional components [2]. It is anticipated that booming population, education, urbanisation, industrialization and affluence will result in a 72% increase in meat consumption by 2030. It is forecasted that production of animal products will double from 229 billion kg for 6.0 billion people in 2000 to 465 billion kg for 9.1 billion people by 2050 [12]. However, the reputation of meat products has recently been impacted due to high levels of saturated fatty acids, cholesterol, salt, and synthetic additives, which are frequently linked to a variety of diseases such as diabetes, obesity, cardiovascular disease, and cancer. The suggestion to restrict the intake of red meat and processed meat has influenced the consumer's perception of meat products. As a result, meat is replaced with various plants, including the co-products and by-products with the added benefit of dietary fibre which is not common in meat products [2].

Nowadays, the use of plant-based waste materials as a functional ingredient in meat products is gaining popularity. The mushroom stems were successfully added to meat products such as chicken nuggets [8] and goat meat nuggets [10]. The incorporation of grey oyster mushroom stems into chicken nuggets improved the texture properties. There is no significant change in the chicken nuggets added with mushroom stems in the pH, cohesiveness and hardness as compared to control. The moisture content was reported to be slightly higher than control due to the high amount of moisture in the stem as compared to the cap part [19]. In terms of overall sensory attributes, consumers preferred the chicken nugget with a 55% grey oyster mushroom stem the most [8]. Enoki mushroom stems added to goat meat nuggets increased dietary fibre and ash content. Moreover, the emulsion stability, water holding capacity and phenolic content of goat meat nuggets were improved and no significant difference was observed in the sensory attributes. The shelf-life of meat products was also extended. The authors

recommended the enoki mushroom stem at a level of 4% as a value-added functional ingredient to attain meat products that are nutritionally improved and healthier [10].

CONCLUSION

Consumers are shifting toward a healthier diet and becoming more concerned about the environment which has led to the development of products based on plant-based alternatives. Mushrooms are widely used in various products, but the potential values of the stems are usually omitted and considered a food waste which poses a challenge in agro-industrial waste management. The underutilised mushroom stems have the potential to be incorporated into meat products as they mimic the texture of meat and contribute to the appealing umami flavour. Furthermore, mushroom stems possess a high nutritional content and could be a promising ingredient to produce a value-added meat product in the current sector that is aligned with consumers' preferences and recent trends.

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PLATFORM C (HEALTH SCIENCE AND TECHNOLOGY)

THE TECHNOLOGY EVOLUTION OF LUNG CANCER SEVERITY DETECTION AMONG MALAYSIAN

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Keywords: *Lung Cancer Detection (LCD), Chest Radiography (CXR), Liquid Biopsy (LB), radiomics, biosensors.*

ABSTRACT

Lungs are the main organs for breathing and are part of the respiratory system. Subsequently, one lethal disease of cancer known as lung cancer is a type of malignancy that grows when abnormal cells in one or both lungs proliferate and reproduce uncontrollably. In the detection of lung cancer, some diagnosis assessment modalities can be employed for instance chest x-ray, computed tomography scan, and magnetic resonance imaging. Although these modalities are incredibly effective aids, a remarkable advancement in the field of lung cancer diagnostics should be implemented. The main goal of this research is to highlight current diagnostic techniques as well as some advanced diagnostic techniques for lung cancer severity detection among Malaysian as lung cancer is one of the most frequent cancers in Malaysia. The epidemiology along with the challenges regarding lung cancer screening are also emphasized.

INTRODUCTION

In Malaysia, several approaches for lung cancer detection (LCD) have been employed. Surveillance with sputum cytology and chest radiography (CXR) has remained used in the past to test for lung cancer [1]. Furthermore, imaging modalities for instance Computed Tomography (CT), Magnetic Resonance Imaging (MRI) with computer-aided diagnostic systems (CAD), and Positron Emission Tomography (PET), have also been utilized to analyze the images and data in detecting lung cancer and determining its aggressiveness [2]. However, CT is the extremely frequent imaging mode for staging since it is less expensive than a positron-emission tomography scan, which is usually reserved for patients with stage II or higher infection and is only available in private practice but both modalities are studied to be the most utilized aids while the application of chest radiography and ultrasonography for performance is infrequent [3].

The screening of lung cancer for early diagnosis is particularly necessary for those who have no signs or a history of lung cancer since it allows them to discover the disease earlier. The most general suggested lung cancer screening test is low-dose computed tomography (LDCT) [4]. The test is indicated for adults who are at a high risk of acquiring the condition due to a history of smoking, and it takes only a few minutes and is painless.

METHODOLOGY

The main goal of this research is to highlight current diagnostic techniques as well as some advanced diagnostic techniques for lung cancer severity detection among Malaysian as lung cancer is one of the most frequent cancers in Malaysia. The epidemiology along with the challenges regarding lung cancer screening are also emphasized. Therefore, this paper reviewed the previous latest studies related to technologies used to diagnose and classify lung cancers into their types and severity.

The review was divided into several categories involving; a) Epidemiology, b) The principle of screening, c) Basic diagnostic imaging techniques of lung cancers, d) The advanced technique used in the recognition of lung cancer in Malaysia, and, e) The challenges regarding lung cancer screening.

RESULT AND DISCUSSION

There are several problems and hurdles to optimum cancer care in resource-poor nations, they can be solved by using evidence-based, systematically sound, resource-level definite, economically achievable, socially suitable, pragmatic, and represent great clinical practice measures. The World Health Organization has advised that recommendations for the management of all major malignancies be developed that are resource-level suitable [5]. The use of guidelines must be adapted to the specific circumstances of each location. Certain tests or procedures may not be accessible in some nations or institutions within the same country. Reorganizing current human resources and infrastructure can significantly improve the situation. Strategic planning, healthcare worker training, simplifying approach to diagnostic and performance services, and civic education are just a few of the national and local initiatives that can support conquering some of the contests of employing lung cancer staging advances in resource-constrained settings. Furthermore, the universal health community must work together, with the help of local governments and primary healthcare systems, to develop cancer care, comprising diagnostic facilities, using appropriate methods for resource-constrained countries' health systems, widely available to low-income patients, and unified into national health assurance systems.

Many imaging modalities are actually can be used for diagnosing lung cancer and each of them provides a unique and informative solution in diagnostic imaging just like CT scan, but what distinguishes the functionality and the usage among them is the technique used in performing the quality of the images and the methods used in detection the abnormality. The focus examination of imaging techniques in this study then concentrates on the evolution of the imaging technique used among Malaysian that have their benefits to the people.

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PLATFORM D (THEORETICAL AND APPLIED COMPUTERS)

ONLINE TRANSACTION FRAUD DETECTION USING BACKLOGGING ON E-COMMERCE WEBSITE: A REVIEW

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***Keywords**: E-Commerce, online transaction, payment fraud, backlogging, software development life cycle.*

ABSTRACT

The objective of this research is to investigate the gaps in the existing online transaction fraud detection on e-commerce websites, to propose and develop an online transaction fraud detection using backlogging on e-commerce websites that is safe against fraud and enables simple and efficient transactions and implement security measures to prevent a breach of the proposed system. The system can receive, store, and process data related to the customer who registers and uses the system. Furthermore, the system is expected to provide a better interactive feature in an e-commerce website and be able to detect any fraudulent transactions and can restrict and prohibit transactions carried out by an attacker. The system is expected to be secured with the implementation of authentication, bcrypt hashing algorithm, and One Time Password (OTP). The research is to develop an e-commerce site as a web-based system that can assist in detecting transaction frauds using backlogging on an e-commerce website when a customer purchases products from the seller through the internet using a web browser. This research uses behavior analysis to identify fraudulent online credit card transactions in real-time. The algorithm also uses a multi-layered security-based strategy for the transaction restrictions established by the relevant user. The customer's spending limit is used to classify transactions, which aids in determining if the current transaction is legitimate or fraudulent. Finding out the user's location is vital in detecting credit card fraud. The system is useful in a small-scale website for detecting fraud, and with additional improvements, it might be employed in a large-scale e-commerce website where thousands of transactions can occur simultaneously.

INTRODUCTION

This paper presents a review analysis under the requirements stage of the research. Online transaction fraud detection on an e-commerce website is a procedure that enables effective implementation of online transactions without fraud activities during e-commerce operations by utilizing a crucial application blockage known as backlogging. It is also regarded as a type of electronic commerce detector, allowing customers to directly purchase products or services from the vendor through the internet using a web browser without any possible fraud activity.

Transaction fraud poses a significant risk to online buying. As online transactions become more popular, the sorts of online transaction fraud linked with them are also on the rise and can negatively impact the financial system [1]. This fraud detection system has the capability of restricting and impeding the attacker's transaction using a real user's credit card information. To legitimize internet commerce and internet shopping, online transaction fraud detection employing backlogging on an e-

commerce website allows a consumer to submit online orders for things or services from a store that serves online customers while ensuring that no fraud occurs.

To address these issues, this system has been designed to handle transactions that exceed the customer's existing transaction limit. During registration, the necessary information will be collected to allow the system to detect any fraudulent user behaviour. The details of all individual transaction purchases are generally unknown to any Fraud Detection System (FDS) functioning at the bank that issues credit cards to cardholders. To overcome this issue, Behaviour and Location Analysis (BLA) is used.

FDS operates at a credit card issuing bank. Each impending transaction is sent to the FDS for verification. FDS obtains the card information and transaction value to determine whether the transaction is real or not. The FDS does not know the items acquired in that transaction. If FDS confirms that the transaction is fraudulent, the bank denies the transaction. The user's buying habits, and geographical location is utilized to validate their identification. In the case that an unexpected pattern is found, the system must be re-verified. The technology identifies unusual patterns in the payment method based on that user's past information. If any unusual patterns are detected, the system will block the transaction and a warning will be given to the user.

Nowadays, people all around the world are opting to purchase online any items they desire. By 2022, internet sales would account for 21% of all consumer purchases globally [2] because so many people make purchases online, which makes online payment fraud keeps increasing day by day. Reference [3] indicates that the role of digital transformation has increased in recent years. While this process has higher advantages and a favourable effect on a nation's growth, it also has certain risks for a large portion of the population. Online payment credentials are a common target for scammers since they do not even need the actual card, the scammers only need the card data that may be kept digitally. For consumers, having their credit card information stolen may be both annoying and frightening. Victims of online payment fraud spend two working days on average canceling their cards and dealing with the consequence.

Payment fraud happens when someone takes another person's credit card information and uses it to make illegitimate transactions or purchases. The actual cardholder or owner of the payment information then sees that their account is being used for transactions or purchases that they did not authorize and files a complaint. This is when the problem starts for company owners, as they will have to settle the disagreement, pay multiple penalties such as chargeback costs and investigation fees, and face an overall loss of time and resources. Due to the threat of fraud, merchant account providers such as banks may terminate a business's merchant account if they find it increasingly insecure to be involved in its transactions. It is simple to understand how payment fraud can be a major hassle for business owners.

METHODOLOGY

The methodology for this research is a waterfall model that includes five phases namely requirements, design, implementation, verification, and maintenance. The requirements phase is to identify the user needs, the design phase is to develop the system, the implementation phase is to execute the system, the verification phase is to test the system, and the maintenance phase is to detect and fix the problems.

RESULTS AND DISCUSSION

Features for the user page include registration, login, view product, and buy the product. Figure 1 displays the user registration page. Here, users first need to register themself with details to access the system.

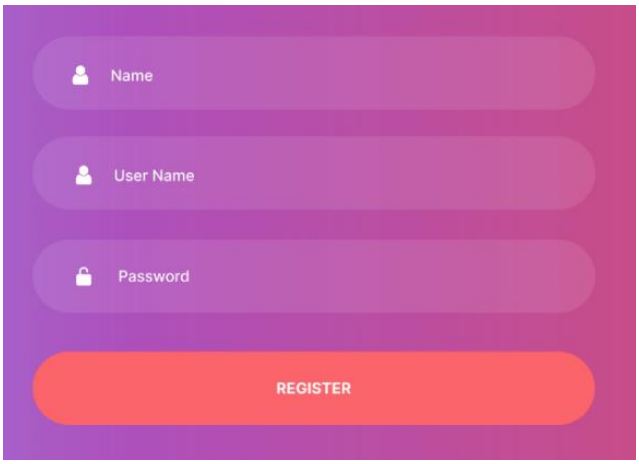

Figure 1. User Registration Page

After successful registration, users then need to login into the system by inserting their credentials into the system. Users can view multiple products with their details on the product page. Interested users can purchase a product online transaction. User is required to fill in their card information which is their card number, CCV number, and expiry date to perform payment on the user payment process page.

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A REVIEW OF THE STUDENT ACADEMIC PLANNER SYSTEM

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***Keywords**: Planning, time planning, time management, planner, organize learning*

ABSTRACT

This paper presents a review of research on UniPlanner, a student academic planner. The objectives of the research are to investigate the gaps in the existing student academic planner for USIM students, to develop a student academic planner named UniPlannner, that has a security feature, and to conduct a user acceptance test to ensure the UniPlanner is working. The scope of the research includes a web-based system named as UniPlanner, that aims to help students to solve their time management problems while increasing the effectiveness of their studies. The security features that will be implemented in this system are password encryption by using the Bcrypt hashing algorithm, password complexity, Google reCAPTCHA, and uploaded file restriction. This system is expected to allow users to record their daily routines and calculate CGPA scores. UniPlanner also allows users to set a reminder and display the important task that must be done. Users also can update the information that has been entered. In a conclusion, this research can benefit users to improve their daily schedules. For future research, the system can be extended to include more features and could be enhanced as a mobile application.

INTRODUCTION

In March 2020, the World Health Organization (WHO) declared a pandemic situation with the spread of a new type of coronavirus that caused the outbreak of COVID-19 [1]. In line with this epidemic declaration, all countries have closed all sectors. The education system is one of the areas severely affected by the COVID-19 pandemic nationwide [2]. The closure of the education department led to the closure of all schools and universities to break the chain of transmission of this dangerous epidemic. As a result, the ancient face-to-face teaching and learning process had to be stopped and replaced with online learning also known as e-learning [3]. In the critical situation of the outbreak of COVID-19, the transition to online learning was the only one [4]. As e-learning is being practiced in student life these days, some students have difficulty managing their time properly between family, studies, and entertainment resulting in substantial disruptions in learning [5]. Students can slip right on the deadline for the assignment or project easily without being noticed. Based on these issues, the researcher decided to develop a system named UniPlanner which will help students to solve their time management problems while increasing the effectiveness of their studies and productivity.

Among the problems that arise from the implementation of new teaching and learning processes which is e-learning is that students have poor management of time. According to [2], time management consisted of several indicators. Activities such as time productivity planning, organization, mobilization, and control are time management efforts. At the beginning of the virtual learning period, students spend more time at home causing them poor at dividing time spending time with family, entertainment, and education. Balancing studies with the fun stuff in life can be challenging to maintain [5]. This unfamiliar learning method and poor time planning cause many students unconsciously miss classes that are conducted virtually or have insufficient time to complete the assignments given because they miss or forget the deadline. When students have too many assignments, students also tend to have

trouble determining and completing assignments according to the priority deadline. To add to this, students had to be more independent and disciplined in their learning process as the physical presence and direct supervision of their educators were not possible [6].

Other than that, a student's academic performance is measured using the Cumulative Grade Average (CGPA). CGPA calculates the overall average of student coursework for all assignments and examination grades for all semesters throughout the study at the university [7]. Since students rely heavily on the CGPA exam results issued by the university, students' academic performance and learning outcomes in the new semester depend a lot on previous achievements. Thus, it can make it difficult for students to plan their studies to achieve their targets and if students do not know how to calculate examination results, they may not be good at planning to score in certain subjects.

Next, in the existing planner system, the reminder features are functioning by sending notifications through email. For students who regularly receive emails, it can cause them to miss reading the email and cause them not to be alerted by the due date. According to [8], the reminder features are designed to help people to remember future tasks that they might otherwise forget. At a minimum, the reminder features should include the types of tasks, task description, the date and time the reminder was created, and the time between the reminder and the notification creation.

Finally, some students are too focused on learning and chasing the deadline causing them to have health problems because they do not wisely divide their time accordingly and spend long hours in a sitting position with supine bent forward while using electronic devices [9] where they study too often without resting or enjoying the entertainment. Although this is good for their academic achievement, it is not good for their mental and physical health.

METHODOLOGY

The methodology for this research is a waterfall model that includes five phases namely requirements, design, implementation, verification, and maintenance. The requirements phase is to identify the user needs, the design phase is to develop the system, the implementation phase is to execute the system, the verification phase is to test the system, and the maintenance phase is to detect and fix the problems.

RESULTS AND DISCUSSION

This section presents the user interface design of UniPlanner. Figure 1 presents the board interface. On the board interface, the task is displayed based on the file. Users can create a new file and add new tasks to the chosen file. If the user wants to edit the task, the user needs to click on the task and edit it. All new tasks will be automatically added to the To-do file and the chosen file. Once the task is completed, the task will be moved to the completed file. If the task is overdue, the task will be moved to a delayed file and the time and date will turn red. The color of the file can be set as user preference.

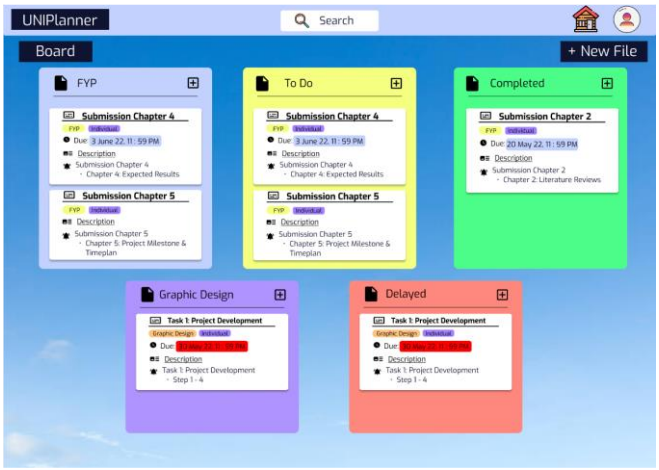

Figure 1. Board Interface

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BIBLIOMETRIC ANALYSIS OF COSMOGENIC RADIONUCLIDE USE IN ENVIRONMENTAL RESEARCH

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Keywords: *Cosmogenic radionuclide, environment, Scopus database*

ABSTRACT

Cosmogenic radionuclides have long been studied since 1940. This knowledge has been used in the field of solar physic, atmospheric, geological system, biosphere as well as material dating. Each of these radionuclides has proven to give so many benefits in our daily lives. This study aims to explore global research trends in the usage of cosmogenic radionuclides in environmental research. The Scopus database has been analysed for several important pieces of information such as publications, sources, languages, countries, affiliations, etc. The analysis revealed that cosmogenic radionuclides are indeed widely used in environmental fields such as soil erosion, sedimentation, weather, and many more. The top three Cosmogenic Radionuclides used in the environmental study are 10Be (53.3%) followed by 26Al (12.99%) and 14C (9.63%). This analysis looks from the year 2010 to 2022 and after the exclusion of any language except English, as many as 1101 written materials whether in the form of book chapters, research articles, reviews, etc. have been identified. Publications are mainly in the form of research articles and 93.5% of the literature is in the English language. Of the total publications, the top three country contributions come from the United States (43.1%), the United Kingdom (21%), and France (18.8%).

INTRODUCTION

A nuclide that has an excess of nuclear energy that makes it unstable is called a radionuclide. This feature or property of a radionuclide has been explored by many researchers around the world and they come out with an option to be applied in many different types of applications in medical, agriculture, manufacturing as well as environment. The prospect of utilizing radioactivity measurements to identify the general characteristics of large-scale atmospheric circulation has been made possible by the discovery in rainwater of a variety of short-lived isotopes created by cosmic radiation. (Lal et al., 1958).

Be7 is one of the cosmogenic radionuclides and several studies focusing on the usage of Be7 has been found such as (Khodadadi et al., 2020) that investigate the possibility of using Be7 as a soil erosion tracer under a range of climatic condition, (Badreddine et al., 2021) study the importance of soil degradation and thus revealed the need for diagnostic of the erosion process. Additionally, they concluded that the utilization of nuclear methods that employ fallout radionuclides (FRN), which also include Be7, is a crucial alternative and useful tool to supplement traditional methods for studying soil erosion. Other cosmogenic radionuclides have also attracted a significant number of researchers in their study that relates to the environment. Given the importance of groundwater management, knowledge of the residence period is considered critical. (Schubert et al., 2020) studied the usage of ^{35}S and showed it is a suitable time tracer for investigating sub-yearly groundwater ages.

Cosmogenic radionuclides with longer half-lives are the most suitable tool to study the important processes in the environmental system as they occur on decadal to millennial or even geological time scales such as climate change. Natural archives such as ice cores, sediments, and tree rings serve as a repository for information about previous environmental situations (J.Beer et al, 2012). The time scales and the dating of significant historical events are fundamentally established by cosmogenic radionuclides. We can better comprehend the past owing to the knowledge in the archives, and understanding the past is essential for forecasting the future.

METHODOLOGY

Data Collection and Processing

The Scopus database is a significant library of peer-reviewed papers and offers coverage of a wide range of subjects and was accessed on 30th August 2022 from the access provided by the University for this study. The period under study was set to take only records from 2010 until 2022. Specific keywords have been identified to be used in the search process to get only articles related to the topic under study. Combining the specific keywords and using the advanced search tool provided by the database, make the process much easier.

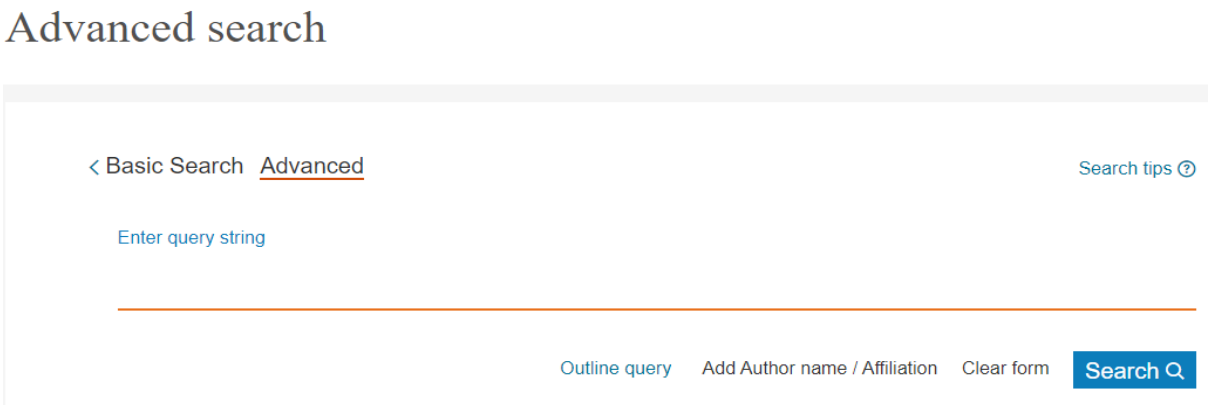

Figure 1. Scopus's Advance Search page

RESULT AND DISCUSSIONS

The United States, the United Kingdom, and France have become the top 3 contributors in terms of the number of documents in this search. Additionally, even though the number is not very significant, several nations have added their names to the list, including Vietnam, Thailand, Bangladesh, Sri Lanka, Nepal, Indonesia, and Singapore. When compared to review articles, book chapters, and other items on the list, research papers accounted for 93.6% of the search results. 52% of the documents were categorized in Earth and Planetary Science subject area and another 11.7% goes to environmental science while other areas such as Physic and Astronomy, Chemistry, Energy, Material Science, and others. As for the extra note, in this search, an article could be categorized in different subject areas by the database.

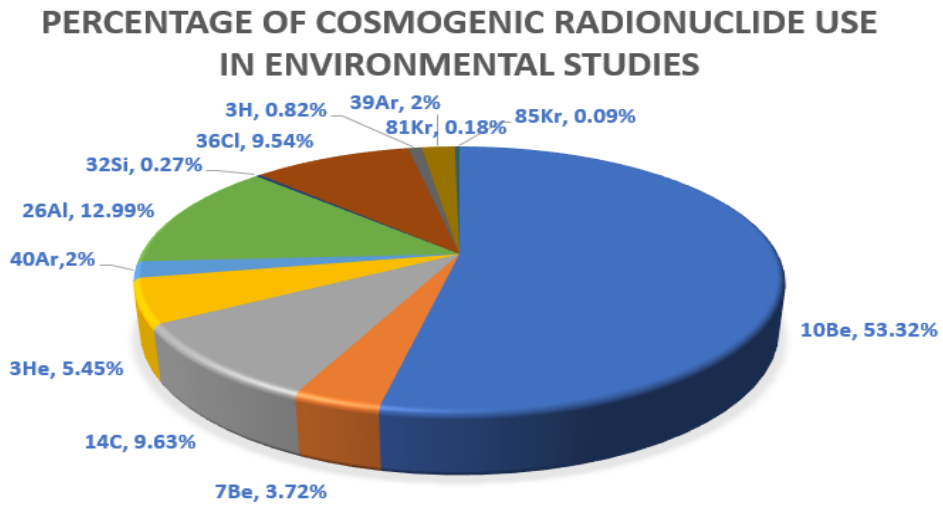

Figure 2. Percentage of Cosmogenic Radionuclide use in Environmental Studies

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A PRELIMINARY EVALUATION OF USIM STUDENTS' CAR BOOKING

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***Keywords**: Mobile application, USIM, telegram, grab real-time location MyRide*

ABSTRACT

The objectives of the research are to investigate the gaps in the existing car booking mobile application for USIM students, to develop a secured car booking mobile application, MyRide, and to implement system testing to ensure MyRide mobile application is working. The scope of the research includes a car positioning module, car position mapping module, and authentication module. The result of the research is a mobile application for car booking called MyRide. The research is to enhance the current method of booking a car.

INTRODUCTION

Among all transportation services, a mobile application is a major technology used by the public as a medium for convenience purposes. A smartphone application is the most simple and convenient way to book a car, especially in a crowded town or metropolis. Back in the old days when the taxi was popular, people need to wait for passing by taxi or make a booking via call. This creates a huge downgrade in transportation service if time and convenience are considered. Creating a transportation system that is easy to use and accessible to the public can be a difficult task, as it must take into consideration the variety of elements that are involved in travel, including the connectivity of the public transportation system [1].

Nowadays, the tech world is emerging as people want services that need less involvement and can be done entirely on their mobile devices. The mobile trend in every industry is massive, from booking flights to renting a hotel. Car booking app development is an example of a service that saves time and money by delivering user-friendly mobile apps. Having a more confident attitude among people toward technology increases the odds of self-booking ride-hailing trips, using an app [2]. In Universiti Sains Islam Malaysia (USIM), for example, students tend to use their mobile phones in case of booking transport, especially cars.

However, USIM has a problem when it comes to booking a car method. Individual public passenger services had been experiencing issues with information asymmetry and coordination between the user and the driver, as it was unclear where to take a taxi, service hours, safety, cleanliness, car quality, driver reliability, driver knowledge of the city, and the fee to be paid for the service provided. To solve these problems and enhance the car booking services, it is essential to have a mobile application that mainly focuses on car booking for USIM students.

There was a situation when providing a good quality of transport services to the public became a great challenge due to the poor service of current public transport. A developing country like Malaysia is still facing low ridership in public transport as one of the reasons people do not use public transport is their dissatisfaction with the lack of information about arrival and departure times [3]. Nevertheless, uprising mobile used to upgrade the transport services via a mobile application like car booking.

METHODOLOGY

The methodology for this research is a waterfall model that includes five phases namely requirements, design, implementation, verification, and maintenance. The requirements phase is to identify the user needs. It includes an online survey that was conducted to require data on existing car booking mobile applications that have been used by USIM students in early 2022. There were 23 respondents from USIM students who answered the survey from 15th May until 29th of May 2022. The design phase is to develop the system, the implementation phase is to execute the system, the verification phase is to test the system, and the maintenance phase is to detect and fix the problems.

RESULTS AND DISCUSSION

Based on Figure 1, Telegram is the most popular mobile application to book a car among USIM students. Grab Car is a runner-up as 26.1% of the respondents are using the app while MyCar is the third choice with 13% and AirAsia ride has the same percentage as EzCab with 4.3% of the respondents.

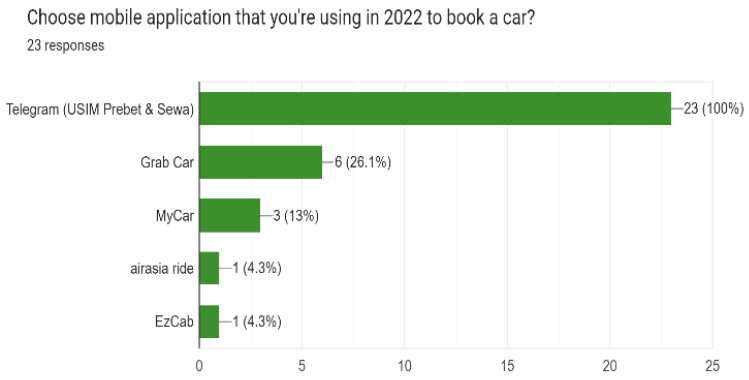

Figure 1. The percentage of existing mobile applications used by USIM students to book a car either using Telegram group (USIM Prebet & Sewa), Grab Car, MyCar, AirAsia ride, or EzCab.

Figure 2 has shown that among 23 respondents, 43.5% are not satisfied with the current existing mobile applications to make a car booking. This result indicates almost half of the respondents have problems with Telegram, Grab Car, MyCar, and other car booking mobile applications in the current market. The survey also includes respondents' reactions to the development of a specific mobile application to book a car among USIM users. Figure 3 shows that 82.6% of respondents said 'Yes' and none of them choose 'No' on the development idea.

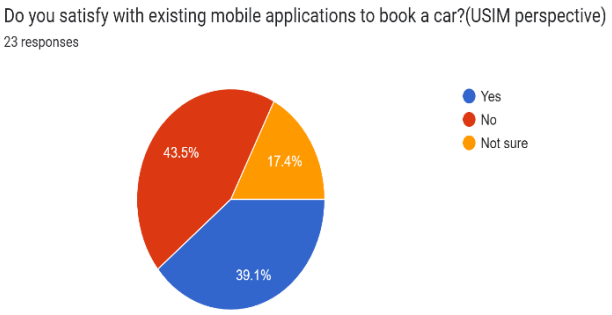

Figure 2. The percentage of user satisfaction on existing mobile applications to book a car.

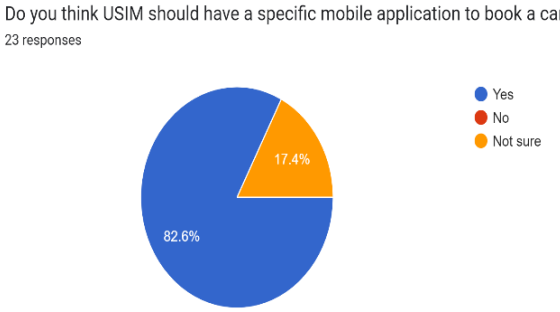

Figure 3. Percentage of respondents' reaction to the development of a specific mobile application to book a car among USIM users.

MyRide will have a few functional requirements such as users can request a ride should be matched to a driver in proximity and can see all nearby drivers. Drivers can answer or decline requests from nearby users. When a trip is created, both parties see each other's real-time location.

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'TRYEAT' VARIETY HALAL FOOD E-COMMERCE SYSTEM: A REVIEW

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***Keywords**: Halal, food, culture, web-based system, user*

ABSTRACT

The objectives of the research are to investigate the gaps in the existing halal food system, develop a secure halal food system, and perform user acceptance testing to ensure the system is working. The scope of the research includes the common login and signup form and allows users to browse the system. Foods will be categorized and listed based on names of races and types of foods, where customers can view vendors' and foods' names along with the price. Vendors will be able to edit, add, or delete their menus within the system. A search bar will also be included throughout the system, based on the databases keyed in by vendors. Next, payment could be made by customers through several methods such as Online Banking or Cash on Delivery (COD). Both customer and vendor will be assigned to retrieve the order information such as preparing the food and the order has been received. Admin will be monitoring all processes in the system such as user registration, order process, and customer services. The result of the research is a web-based halal system that shall be helping people to ensure and enlighten their foods of buying are halal without any doubt. In a conclusion, the system's name 'TryEat' is an online system meant to overcome the issues where it aims to monitor every in-process food making, the vendor's halal status, ingredients used, and strictly prohibited any doubting elements throughout the registration phase.

INTRODUCTION

Technological evolution brings obvious changes into today's world where we mostly use artificial intelligence, system-based and cashless. Nowadays, there are uncountable 'e-commerce' or electronic commerce businesses across the globe, where people can sell, buy, or even get information through it, including the food industry. The reason for it to stay relevant is surely it brings ease to people such as saving time, faster and works efficiently where customers can now skip the queue and continue their job while waiting for the food to arrive at their doorstep.

Food buying systems consist of two different categories which firstly is the delivery services by the restaurant itself such as KFC or McDonald's and secondly, third-party intermediary platforms such as Foodpanda and GrabFood which are the popular applications nowadays, as most people have one of them in hand. These apps are very convenient and helpful during our busy days as we can choose virtually and make instant payments. Though, some of the features available in these apps did not include the verification status of halal, either for the vendor, food, or both. Therefore, this 'TryEat' web-based system will be serving verification to the users to avoid any confusion or doubt while ordering by monitoring every in-process, list of ingredients used, and vendor's status and activities.

Furthermore, living in such a beautiful world, full of multiple races, cultures, and traditions, unites people into one, especially in a multi-race country like Malaysia. Food is one of the main topics to be spoken of, along with the word 'culture'. Hence, this 'TryEat' Variety Halal Food E-commerce System project is developed to also bring awareness to their users regarding global cultures, where in

this system, foods will be categorized by races' names such as Malay, Indian, Chinese, Korean, and Japanese as every culture pride itself on different dishes. Thus, the customers can be open to new meals and try something new, complying with the chosen system name of 'TryEat' which brings a similar sound to 'try it, encouraging people to try something new, worry-free.

Current existing systems did not provide strict notification or alert regarding the halal status in any food or vendor. Therefore, users might sometimes overlook while ordering, especially when in rush. Moreover, some products contain a doubting name, for example, a complete halal cafe in Temerloh, named 'Kopi dan Bunga' sells a drink called 'butter beer' which is a caramelized coffee containing not any beer, but brings confusion to customers. An article in New Strait Times stated that under the Food Act, the law on food labeling needs to be amended to ensure that Haram ingredients are mentioned on the label. If a substance can be obtained from several sources, then the producer should be required to the state from which source it was obtained [1]. Therefore, it is a must for the vendor to always keep their products doubt-free.

Some people were not exposed to other races' cultures and eventually have been forgotten. This statement goes along with the traditional foods of other cultures, where we tend to only know ours, despite any other more. This might also happen to people who grow up befriending only among the same race, culture, or religion, as has been stated by [2]. All this means there is an increasing number of Malaysians who are growing up with little or no interaction with people of other races, said the news.

Next, people need to do self-survey on online platforms such as Instagram, Facebook, or Twitter to look up available related accounts regarding their desired craves, which surely takes up some time. Furthermore, sometimes the account they found is located miles away, closed, or even inactive anymore. By having a website, they can browse it all at the same time, along with the food availability near their location. In an article entitled 20 E-Commerce Advantages and Disadvantages You Need to Know written by [3], most businesses experience a delay in responding to customer inquiries. As in food matters, surely customers do want a quick response during their lunch or dinner time where replies within hours surely swipe off their desires to eat. Slow responses will highly bring anger in them and shop somewhere else instead, which the only option the seller had is to be online 24/7. Nevertheless, [4], have also mentioned in their writing of The Emergence of Online Halal Food Delivery Services in Brunei Darussalam Amidst Covid-19 where 84.5 percent of Brunei's online food ordering system consumers order their food online willingly as it is convenient and saving up their time and they do not have to leave the house.

METHODOLOGY

The methodology for this research is a waterfall model that includes five phases namely requirements, design, implementation, verification, and maintenance. The requirements phase is to identify the user needs, the design phase is to develop the system, the implementation phase is to execute the system, the verification phase is to test the system, and the maintenance phase is to detect and fix the problems.

RESULTS AND DISCUSSION

Graphic User Interface (GUI) or System Interface Design where all the expected results of the system development shall be illustrated. The implementation will be done based on these interfaces to create a working system. The designs however came except for changes as it evolves during the development process. Figure 1 is the system's main page which is the first page users will encounter. Users can choose between two options which are 'Join Now' to register or 'Login' if they are existing users.

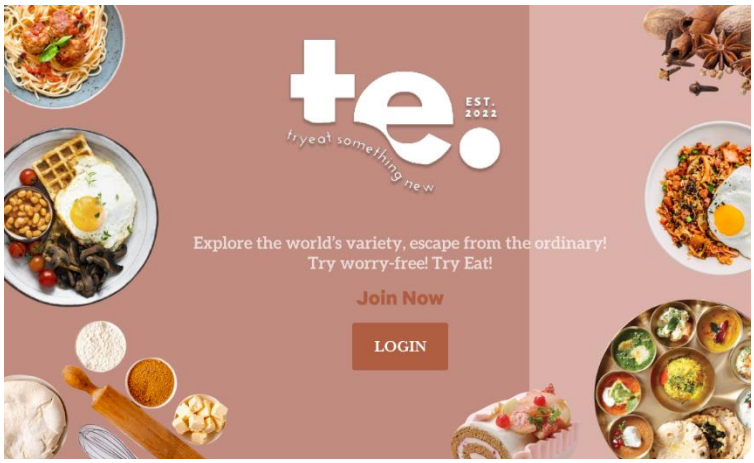

Figure 1. Main page

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PLATFORM FIC

Eco-CalDent

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ABSTRACT

Root surface debridement (RSD) practical requires dental students to perform RSD on mounted natural teeth with calculus. Major problem faced is the teeth will easily come out during the procedure, hence will disrupt the practical session. The innovation of Eco-CalDent is aimed to solve the problem faced by dental students utilizing recycled plastic-based waste products. Currently the acrylic waste from prosthodontic practical session is thrown away and may contribute to global warming issue. EcoCalDent is an artificial calculus made of acrylic, sugar, salts, water and lime powder that can be painted on plastic teeth model to resemble dental calculus. Similar commercial material is not resembling dental calculus in terms of texture and difficulty in removal. It is cheaper than commercial product and time saving as the practical session will not be disrupted to re-mount the dislodged teeth. In addition, the acrylic waste can be recycled and reduces the amount of plastic-based waste product. It is believed that Eco-CalDent can be commercialized to facilitate periodontal practical session.

CelF Biofilm: Green Conducting Biofilm

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ABSTRACT

Beginning in the 1990s, portables devices such as mobile phones, smartphones, media player (discman, mp3), digital watch etc. were developed, commercialized and becoming popular since and hence led to increased battery demand. This can be seen from several reports which estimates that global battery market value to increase from USD 100B in 2021 to USD 170B in 2026. Nevertheless, current conventional battery technology suffers from some problems: 1) expensive – due to the use of scarce precious metal (cobalt, nickel, lithium etc.) in electrolyte and electrode construction and 2) Safety issue – due to the use of liquid organic materials (solvents) in battery electrolyte. Furthermore, the liquid electrolyte is prone to leakage, reactive and flammable which pose risk to consumers due to toxic and hazardous properties of the organic materials. This innovation, CelF Biofilm aims to overcome these problems by using green and inexpensive materials. The CelF Biofilm is a solid-state electrolyte that use cellulose-based materials (from natural sources) as the core building blocks to reduce the risk and environmental impact. The CelF Biofilm possess great characteristics such as; low cost – usage of inexpensive core materials and simple preparation technique; flexible – free standing film that can be bend and cut into any desired shape; safer – discards the use of costly and hazardous materials that are commonly used in conventional electrolyte; and good performance – the ionic conductivity achieved the minimum value needed (~10-4 S/cm) for electrochemical application. Ultimately, combination of these CelF Biofilm characteristics allows the possibility of cheaper and greener energy storage technology for sustainable future.

Development of Low-Cost Coupling Agent Alternative for Medical Ultrasound Probe

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Keywords: *Coupling agent, gel, ultrasound, corn starch flour, 3D printing.*

ABSTRACT

Ultrasound is an important medical imaging modality known for its low-cost and non-ionizing qualities. With the current commercial ultrasound gel, it is made from compounds that can be challenging to obtain and not widely available in rural areas, in addition to its costly per unit price. Here, we present a novel ultrasound gel alternative using compounds that are widely available, safer, cheaper, and give similar, if not better quality ultrasound images with the existing water-based ultrasound gel. This study has produced a low-cost ultrasound gel alternative using corn starch flour as the main compound. The corn starch gel was created by combining one part of corn starch flour with 10 parts of distilled water, stirring continuously over low heat for 3–5 minutes. Once the corn starch liquid had solidified, triethanolamine was mixed in the solution to act as a pH stabilizer. Several gel formulas were created using a higher corn starch ratio and a higher water ratio gel. The gels were dissolved in carboxymethyl cellulose and laced with glycerine to increase their lubricant properties before the finished products were cut into small blocks measuring 6 cm (length) x 1.6 cm (height). The corn starch gel was tested using a Siemens Acuson NX2 ultrasound machine curvilinear probe and the depth of penetration from the surface to a water-based phantom was recorded at 2 cm. We conclude that this corn starch gel needs further tests on the corn starch flour-to-water ratio to create a coupling agent that can demonstrate better quality and anatomically realistic ultrasound images viable to the current commercial ultrasound gel.

Telang pH Indicator Kit

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Keywords: *pH indicator, telang natural indicator, flaviliumcation, anthocyanins, pH kit.*

ABSTRACT

Indeed, people experience the effect of pH every day, all around us; in the things they touch, eat, and even inside their bodies. The pH of unknown materials can be determined by using an indicator, which is usually a liquid or a specially treated paper that changes colour in predictable ways when it touches an acid or a base. Taking this concept into account, innovation has been developed in a way to make pH exploration more wonderful. A Telang pH Indicator Kit introducing a new way to teach experiential science. This kit could be a comprehensive learning solution that is designed to bring science to life by providing all the students need for hands-on learning regardless of the location the learning is held. Although, the pH indicator also can be made at home, however, with this kit, students should be able to understand the fundamental of pH detection and increase their measuring skills. This kit utilized "Bunga Telang" as an organic and natural compound that contains Anthocyanins which will naturally change colour when they react with different levels of pH. The anthocyanins in the flowers had flaviliumcation that is unstable to the changes of pH solution, resulting in the change of the original colour of Telang solution. In other words, the pH might give an effect of discolouration. This experimental experience is valuable that students can just experiment with it at home. Meanwhile, it helps teachers to enhance the teaching method thus making the class session fun too.

Introduction

pH is a measurement of levelling the acidic or basic of substances. This measurement using a scale from 0 to 14 indicates how acidic or basic of tested samples. A substance with a pH of 7 is neutral, while substances with a pH of less than 7 are acid and more than 7 is considered base. The stronger the acid is shown by the number approaching 0. Similarly to the base, any number approaching 14, indicated a stronger base. The pH experiment need tool to ensure the value of acidic or basic. Most institutions use pH meters or pH stripes to test the samples. However, there is an effort carried out to make the experiment more fun, easier and user-friendly, allowing people to experiment with pH measurement, even in their comfortable homes. Telang pH Indicator Kit is create utilised the concept of pH measurement experiment,

involving the principle of the chemical ion changes resulting in the ion of H+ and H3O+ determining the acidic or basic level of substances. This ion will also changes the colour of tested substances, thus allowing us to compare them with a standard pH colour scale.
This all-in-one kit is compact and affordable, offered an interactive learning while experimenting it. It would help kids to understand the science concept in a very simplest way at the same time provide valuable hands-on scientific skill to kids.

Methodology

The kit consists of an instruction manual, Telang powder, small cup, pipets and test tubes. The experiment starts with mixing the water and the Telang powder until they become homogenous. Then pour the solution into several test tubes. Kids can use their creativity in experimenting with this kit. They can use any sample they can find at home such as orange or lime juice, toothpaste solution, baking soda solution, milk etc. Pour the sample into test tubes containing the Telang solution. Observes the changes in the colour of mixtures. Compare the colour with the pH colour scale provided in the instruction manual to determine the pH of each sample.

Result and Discussion

Kids will learn the science of pH determination so easily. This kit helps to improve not just the basic scientific knowledge relating to acid and base, but also gives a good experience for the scientific pH testing process.

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MuFish Sausage©: Mushroom Fish Black Tilapia Sausage

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Keywords: *Mushroom sausages, nutritious fish sausages, high protein sausages.*

ABSTRACT

Fish surimi is commonly used by manufacturers as raw ingredients for production of fish product emulsions such as sausages, bologna, and loaf. Consumption of surimi based-products are increasing demand amongst consumers and most of the surimi in the market are from marine fishes compared to freshwater fishes. The marine fish's raw materials are more expensive, and the sources are limited due to the over exploitation of fishing which significantly depletes its populations. Therefore, freshwater fish is considered as the alternative fish for surimi production due to low market prices, and desirable mince colour. Surimi based-products from freshwater fishes could also provide good gelling properties with other ingredients. Therefore, in this study MuFish Sausage© was produced from freshwater fish black tilapia surimi added with different kinds of mushroom (Enoki, Grey Oyster, and White Button) to evaluate its physical properties and its consumers' acceptability using Hedonic Test. Black tilapia surimi was used as major ingredient for the MuFish Sausage© as it contains high protein and low saturated fat as well as easily available in local market. Mushrooms were added in the MuFish Sausage© formulation due to the high content of protein and fibre, low in fat, and found a feasible property for fish sausage as well as to provide seafood flavour and umami taste. In was found that MuFish Sausage© provides softer texture from control sausage which makes them easily to bite for people. These products contain high protein and fibres, low fat, and calories. Furthermore, MuFish Sausage© with white button mushroom obtained the highest degree of liking for all attributes. Different types of mushrooms in MuFish Sausages© formulation did not affect *(P*>0.05) the customers' degree of liking in term of appearance, colour, fish aroma, fish taste between MuFish Sausage© formulation. Therefore, Mufish Sausage© is suitable for all people in all age categories to fulfil the need of a delicious healthy processed foods.

Development of game-based learning (i-Tajweed) using a proposed sustainable game design framework (SUSGAD) for motivating students in learning Tajweed

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ABSTRACT

In this era, games are becoming as popular tools that have been widely used in teaching and learning process. Recent studies show that games has their own potential in increasing motivation and then gives positive impact towards studies. At the same time, many studies related to sustainability have been conducted in numerous fields. However, existing studies in sustainability are focus more on the product's environmental impact of the software engineering domain rather than sustainability elements in development process. Since game design is a crucial aspect towards the successful implementation of game-based learning (GBL), the development of sustainable game design framework is needed. Thus, the design and development of the games and its sustainability elements should be explored in detail to gain the expected benefits of the game. In this study, the implementation of motivation technique from our prophet Muhammad saw will be used in the process of design and development. The results of this study are a proposed framework that expected to give as guideline for game designers in improving the potential benefits of games especially on Islamic field.

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