i-SPiKE 2023

INTERNATIONAL EXHIBITION & SYMPOSIUM ON PRODUCTIVITY, INNOVATION, KNOWLEDGE & EDUCATION

"Optimizing Innovation in Knowledge, Education and Design"

EXTENDED ABSTRACT

e ISBN 978-967-2948-56-8

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eISBN 978-967-2948-56-8

Published by:
Universiti Teknologi MARA (UiTM) Cawangan Kedah,
Sungai Petani Campus,
08400 Merbok,
Kedah,
Malaysia.

Assalamualaikum warahmatullahi wabarakatuh,

First and foremost, I would like to express my gratitude to the organizing committee of i-Spike 2023 for their tremendous efforts in bringing this online competition a reality . I must extend my congratulations to the committee for successfully delivering on their promise to make i-Spike 2023 a meaningful event for academics worldwide.

The theme for this event, 'Optimizing Innovation in Knowledge, Education, and Design,' is both timely and highly relevant in today's world, especially at the tertiary level. Innovation plays a central role in our daily lives, offering new solutions for products, processes, and services By adopting a strategic approach to 'Optimizing Innovation in Knowledge, Education, and Design,' we have the potential to enhance support for learners and educators, while also expanding opportunities for learner engagement, interactivity, and access to education.

I am awed by the magnitude and multitude of participants in this competition. I am also confident that all the innovations presented have provided valuable insights into the significance of innovative and advanced teaching materials in promoting sustainable development for the betterment of teaching and learning. Hopefully, this will mark the beginning of a long series of i-Spike events in the future.

It is also my hope that you find i-Spike 2023 to be an excellent platform for learning, sharing, and collaboration. Once again, I want to thank all the committee members of i-Spike 2023 for their hard work in making this event a reality I would also like to extend my congratulations to all the winners, and I hope that each of you will successfully achieve your intended goals through your participation in this competition.

Professor Dr. Roshima Haji Said
RECTOR
UiTM KEDAH BRANCH

WELCOME MESSAGE (i-SPiKE 2023 CHAIR)

We are looking forward to welcoming you to the 3rd International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education 2023 (i-SPiKE 2023). Your presence here is a clear, crystal-clear testimony to the importance you place on the research and innovation arena. The theme of this year's Innovation is "*Optimizing Innovation in Knowledge, Education, & Design*". We believe that the presentations by the distinguished innovators will contribute immensely to a deeper understanding of the current issues in relation to the theme.

i-SPiKE 2023 offers a platform for nurturing the next generation of innovators and fostering cutting-edge innovations at the crossroads of collaboration, creativity, and enthusiasm. We enthusiastically welcome junior and young inventors from schools and universities, as well as local and foreign academicians and industry professionals, to showcase their innovative products and engage in knowledge sharing. All submissions have been rigorously evaluated by expert juries comprising professionals from both industry and academia.

On behalf of the conference organisers, I would like to extend our sincere thanks for your participation, and we hope you enjoy the event. A special note of appreciation goes out to all the committee members of i-SPiKE 2023; your dedication and hard work are greatly appreciated.

Dr. Junaida Ismail

Chair

3rd International Exhibition & Symposium Productivity, Innovation, Knowledge, and Education 2023 (i-SPiKE 2023)

OPF PAPER: WET STRENGTH IN PAPER MAKING FROM OIL PALM FRONDS

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ABSTRACT

This study is about the oil palm fronds (OPF) as raw materials and its contents to make pulp and paper. The paper is consisted a network of cellulose fibre bonded together. Different way treated paper different achievement of strength. Each of the fibre contact is very sensitive to water and easily to break as the water wet the fibres which swell. This study was conducted in view of exploring and the paper making potential be as filter paper function with addition of wet strength resin to improve the quality of Oil Palm Fronds (OPF) paper. Bleaching process is done in early stages to remove residual lignin and make it more brighter than OPF raw colour. The addition of Melamine Urea Formaldehyde (MUF) into the Oil Palm Frond pulp fibre to improve the quality and increase the wet tensile strength in paper. Melamine Urea Formaldehyde (MUF) gives higher degree of interatomic attraction which is hydrogen bonding than normally occurs in paper. The values of wet tensile strength between both were compared which are 17.23 g/nm2 for Oil Palm Fronds (OPF) Paper with Melamine Urea Formaldehyde (MUF) and 26.44 g/nm2 for commercial filter paper. Oil Palm Fronds (OPF) as raw material with addition of glue showed tremendous potential can be like commercial filter paper as the result between both showed slightly similar in mechanical and chemical testing.

Keywords: Oil Palm Fronds (OPF), Melamine Urea Formaldehyde, wet tensile strength,

INTRODUCTION

Background of study

Oil palm or scientific name *Elaeis Guineensis* is a delicate plant that was introduced in 1870 in Malaysia. Seeing that in 1960, the planted area had grown up and a palm tree was planted in 1.5 million hectares in 1985. In 2017 it rose to 4.3 million hectares. In Malaysia, it was proved as the most essential asset crop which in 2011, 4.917 million hectares of the total cultivated area were developed (Hubbe and Bowden, 2009).

Palm Oil Tree is rapidly grown in global demand as input for cosmetics, animal feed, food products, and others. The production of oil palm has brought to unlimited economic profits and currently, it is as contributors to the economic sector in Malaysia (Wan Daud and Law, 2015). Each part of the oil palm tree-like oil palm fronds, stem, and fruit bunches consists of fibers.

Based on the recent study, these were suited to use as a raw material in the production of paper. In this study, oil palm frond was selected as raw material in papermaking as it contains higher fibers than other parts. Since, OPF is highly fibrous the characteristics is spongy and fibrous in nature, it is desirably used in the production of cellulose nanocrystals (CNC) for recent years (Nordin et al., 2017). Cellulose, lignin and hemicellulose are the major components in natural fiber and they bonded tightly by mechanical interactions, hydrogen bonds and van der Waals forces between domains of microfibrils (Myers and George., 1985).

Figure 1.1.1: Oil Palm Frond (OPF)

Different amount of fibers give different performances for paper. Fiber quality is the factor in papermaking. The properties of fibers like fiber length and strength of raw material pulps and dry sheets have been demonstrated (Seth, 2011). Apart from improving the formation, which indirectly influences many sheet properties, reducing fiber length has a little direct effect on the sheet structural and optical properties.

Based on the recent study, the paper is very abroad range of products with a different coating. In improving the quality of paper, the industry was used several of glue that can be holding two surfaces together. An adhesive must wet the surfaces, adhere to the surfaces, develop strength after it has been applied. For this study in the production of quality paper, this concept which used glue in the improvement of wet strength in the production of paper was observed. The addition of wet strength to any type of paper regardless of whether it is produced under acid, neutral or alkaline conditions. Hence, numerous grades of paper undergo the alkaline process for many reasons such as strength and softness. By using alkaline fillers, high wet strength paper products have been groomed by the addition of a cationic resin in polymeric reaction product (Hubbe and Bowden, 2009).

Wet strength additive chemical is used in this study which is Melamine Urea Formaldehyde (MUF). These additives perform when the paper in wet condition, it retains its strength. MUF polymerize in the paper and result in strengthening bonding (Nguyen, 2000). Melamine reacts with Formaldehyde, methylol derivatives ranging from mono- to hexamethylol melamine depending on the number of amino by androgens that are replaced by methylol group. Methylol derivatives used in the treatment of cellulosic fiber of the paper. Methylol melamines undergo polymerization in the presence of Hydrocholoric acid (HCL) to form colloidal particles and result in wet strength of paper. Corresponding to the greater abundance of functional groups in melamine, paper produced from these resins has greater wet strength per unit of resin used and greater permanence during aging (Fornue et al., 2011).

Nowadays, issue paper quality is high as users demand high-quality products with better mechanical properties. Paper is an essential thing in daily life for all scope of career as it always used in education, office equipment and many more. When it in wet condition, the notes on paper cannot be read as the ink mixed with water and the most problem is the paper strength will break easily. Once the paper gets rewetted, the strength will lose a lot, the performance very low. The tensile strength is break and the paper in wet condition no longer can be used. Poor tensile strength also the main experts of user complaints in paper manufacture.

The research of this study in papermaking from palm can be the useful one in order to produce more efficacious analogs and improve performance of paper in wet condition. The paper was made from extraction of fibre and then treated with wet strength resin for improvement of paper quality. The result and data obtained from this study can give benefit to other agriculture residues for manufacturers like board and miscellaneous products. Also with further study can find more about the reaction of fibre in oil palm fronds with wet strength such as the formation of inter-fibre bond and the influence of strength.

This research will provide knowledge about the papermaking process with addition cationic starch in pulp fibre to analyze the fibre-fibre bond and interatomic attraction in paper Besides, this study also provides a comparison between different type of fibre used with addition glue between commercial filter paper and paper from hardwood fibre with melamine urea formaldehyde (MUF)

1.4 Objectives of study

a) To observe the wet tensile strength in Oil Palm Fronds (OPF) paper with addition of glue, Melamine Urea Formaldehyde (MUF).

b) To produce Oil Palm Fronds (OPF) paper with similar function as commercialized filter paper.

3.1 METHODS

3.1.1 Modification of Composition dried pulp palm oil frond.

400 grams of dried pulp oil palm frond and 80 grams of sodium hydroxide were weighted. 80 grams of sodium hydroxide and 2400 ml of water were placed in the 3000 ml beaker. Sodium hydroxide was stirred until it dissolved in water over approximately 15 min, by using glass rod. Dried pulp oil palm frond was placed in the MK digester. The mixtures of sodium hydroxide and water were added. The mixtures were blended for 3 hours.

The pulping process was conducted to change the composition of dried pulp oil palm frond by cooking it with 170°C.

3.1.1 Cleaning and Screening Oil Palm Frond

After 3 hours, the oil palm frond was collected from MK digester. The texture became soften as it achieved consistency. Oil palm frond was washed with water to remove unwanted impurities and remaining lignin. After rinsed, it was diluted with water as water act as conveyor for fiber.. The ground of oil palm frond was screened using a Somerville screen with a diameter of 0.15 mm. then, the screened oil palm frond was dried by using a washing machine and left for overnight in the refrigerator before going to the next step. The steps were repeated for four times to get enough samples.

3.1.2 Pre-Treatment of Oil Palm Frond

During this treatment, it was done four times with different types of bleaching agents. Bleaching was done for removing natural color which is inherent in the fiber. Table below was followed in this step:

Table 3.4.3: Step in bleaching agents.

	H_2O_2	NaOH	CH_3COOH	Water
Step 1	23 ml	5.8 g	-	Total until 500 ml
Step 2	200 ml	-	200 ml	Total until 500 ml Total until 500 ml Total until 500 ml
Step 3	-	6g	-	
Step 4	200 ml	-	200 ml	

120 grams of oil palm frond was weighted. Then, mixed with each solution and placed in a plastic bag. Then, it was placed into a water bath at 70°C for 45 minutes. After 45 minutes, the oil palm frond was cooled before washed with water and dried in the washing machine. The dried oil palm frond was put back again in a plastic bag to proceed until step 4.

3.1.1 Formation of Hand Sheet Paper

90 grams of oil palm frond was weighted. Placed it in standard disintegrate machine with speed 3000 rpm after dilution of water with total solution 2000 ml. Water was added slowly into hand sheet mould until reached the level about one inch above the screen. Then, the mixture was poured into the hand sheet mould and perforated stirred used to mix the solution together. The drain of the machine was opened with a rapid movement to dry out the water through the sheet under suction and paper was form on the wire mesh. The bloated paper was then used to lift the paper-to-paper sheet machine to air blow the paper. Then, the paper was dried in the air conditioner room for 2 days before the testing of paper.

3.1 Physical Testing of Trial Paper

3.1.1 Thickness of Paper

The digital micrometer was used to inspect to measure the left side, middle and right side. All the data was recorded.

3.1.1 Weighting and Cutting the Paper

The gsm was weighed to identify the mass of paper. The paper was cut to follow Figure 3.1.

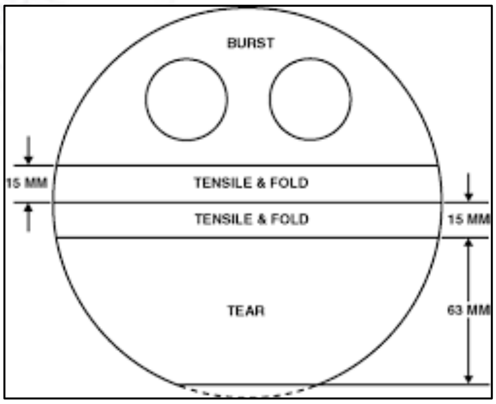

Figure 3.5.2: Paper cut guidelines for further testing (*Sethi et al*., 2019)

3.1.1 Wet shear strength test

The wet shear strength of paper were tested by several pieces of paper with different MUF used were cut into shear specimen about 25mm X 25mm for gluing area. The small pieces of paper they were submerged in water. Then, tensile tester machine was used to test the value wet shear strength of paper with speed 10.0 mm/min. All the force (N) of the bonded was damaged were recorded. Wet shear strength (MPa) was calculated using the following formula. The evidence of the functional group to present in the dried paper is vibrations of bonds will be observed using the FTIR spectroscopy. The infra-red spectra of chemical structures of resins and the functional group will be studied by using a Perkin Elmer Spectrum™ 100 FTIR Spectrometer. All the functional group presence was labeled.

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e ISBN 978-967-2948-56-8

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