2ND EDITION

E-EXTENDED
ABSTRACT

INTERNATIONAL AGROTECHNOLOGY INNOVATION SYMPOSIUM (i-AIS)

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Published 2023
Faculty of Plantation and Agrotechnology
Universiti Teknologi MARA Cawangan Melaka Kampus Jasin
77300 Merlimau Melaka.

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Mode of access Internet

https://sites.google.com/view/ais2023/publication

Perpustakaan Negara Malaysia Cataloguing -in – Publication Data

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ABOUT FACULTY OF PLANTATION AND AGROTECHNOLOGY

The Faculty of Plantation and Agrotechnology was established in 2010 at Universiti Teknologi MARA (UiTM). The mission of the faculty is to play the vital role of producing well-trained professionals in all areas of plantation and agriculture-related industries at national and international levels.

Bachelor of Science (Hons) Plantation Technology and Management is a three-year program that strongly emphasizes the various aspects of Production Technology, Management, and Information Technology highly sought after by the agricultural and plantation sectors. Students in this program will be fully trained to serve as professionals in the plantation sector and related industries. They will have ample opportunities to fulfill important positions in the plantation industry such as plantation executives. This program provides a strong balance of technology and management courses essential for the plantation industry such as management of plantation crops, soil fertility, plantation management operation, plantation crop mechanization, and agricultural precision. As an integral part of the program, students will be required to undergo industrial attachment to gain managerial skills in the plantation industry.

The faculty is highly committed to disseminating, imparting, and fostering intellectual development and research to meet the changing needs of the plantation and agriculture sectors. With this regard, numerous undergraduate and postgraduate programs have been offered by the government's intention to produce professionals and entrepreneurs who are knowledgeable and highly skilled in the plantation, agriculture, and agrotechnology sectors.

PREFACE

International Agrotechnology Innovation Symposium (i-AIS) is a platform to be formed for students/lecturers/ staff to share creativity in applying the knowledge that is related to the world of Agrotechnology in the form of posters. This virtual poster competition takes place on the 1st of December 2022 and ends on the 8th of January 2023. This competition is an assessment of students in determining the level of understanding, creativity, and group work for the subject related to agrotechnology and being able to apply it to the field of Agrotechnology. The i-AIS 2022 program takes place from December 1, 2022, to January 8, 2023. The program was officiated by the Dean of the Faculty of Plantation and Agrotechnology, namely Prof. Madya Ts. Dr. Azma Yusuf. The program involves students from faculties of the Faculty of Plantation and Agrotechnology (FPA)and HEP participating in i-AIS 2022, namely, the Faculty of Education and Pre-Higher Education. This program involves the UiTM student and some of the non-UiTM students which come from the international university and the local university. Two categories are contested, namely UiTM and non-UiTM. To date, students from these programs have shown remarkable achievements in academic performance and participation in national as well as international competitions.

This competition is an open door for the students and lecturers to exhibit creative minds stemming from curiosity. Several e-content projects have been evaluated by esteemed judges and that has led to the birth of this E-Poster Book. Ideas and novelties are celebrated, and participants are applauded for displaying ingenious minds in their ideas.

It is hoped that such an effort continues to breed so that there is always an outlet for these creative minds to grow.

Thank you.

Dean
On behalf of the Organizing Committee
Conference Chair
Universiti Teknologi MARA
Faculty of Plantation and Agrotechnology
http://fpa.uitm.edu.my

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UTILIZATION OF RICE STRAW AS A PAPER

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ABSTRACT - Every year, the rice harvest season is followed by raging fires in rice growing areas. This is because farmers burn unwanted straw in the open which will cause air pollution. Unbeknownst to them, rice straw is one of the most important materials that have been used for pulp and paper production because of its abundance and cost effectiveness. In relation to that, the process of converting rice straw to paper is an initiative to overcome the problem with the removed rice straw being mixed with used paper to make recycled paper with acceptable properties. Develop sustainable processing technology that can convert agricultural waste such as rice straw into pulp. The soda pulp manufacturing process was carried out to remove lignin. This process was designed to measure the effects of sodium hydroxide concentration and temperature on cellulose and lignin content of rice straw, and tensile strength and water absorption. Using NaOH concentration (4-10% w/w) and temperature (60-9^{0}C) for 1 hour with a ratio between rice straw and used paper (1:1-1:9) with NaOH concentration 8% and temperature 90°C. The result of this is the highest total cellulose content and tensile strength and the lowest total lignin content and water absorption.

Keywords: *Oryza sativa L,* Rice straw, Agriculture waste, Soda pulping process, Paper making

INTRODUCTION

Most Asians consider rice, or *Oryza sativa L*., to be a basic diet. The finished result of rice processing is frequently referred to as rice in our culture. If wheat is consumed in Europe, rice is the primary source of carbs. However, utilizing rice straw, rice may also be used to produce other goods outside rice, such as paper and other goods. The shortage of resources, environmental contamination, and the quality of technological equipment are the three key issues that have plagued the growth of the paper industry in recent years and will continue to do so. However, after harvesting, rice straw is frequently burnt or thrown aside. This is due to farmers burning unused straw outside, which will pollute the air. Unbeknownst to them, rice straw is one of the most significant resources utilized in the manufacturing of pulp and paper due to its availability and affordability. Rice straw contains 33-40% cellulose, 24-28% hemicellulose and 2-25% lignin. Non-wood resources including bagasse, rice straw, maize straw, bamboo, grass, etc. are used to make cellulose.

In connection with that, the method of turning rice straw into paper is a project to solve the issue of air pollution. To create recycled paper with suitable qualities, the removed rice straw has been combined with old paper. Create environmentally friendly processing system that can pulpify agricultural waste, such as rice straw. Lignin was eliminated during the production of soda pulp. Using NaOH concentration (4-10% w/w) and temperature (60-90oC) for 1 hour with a ratio between rice straw and used paper (1:1-1:9) with NaOH concentration 8% and temperature 90°C. The delignification was designed to measure the effects in terms of sodium hydroxide concentration and temperature on the cellulose and lignin content of rice straw, and its tensile strength and water absorption to establish the optimum operating pulping conditions. The ratio of used paper mixture to rice straw was varied in order to observe the physical properties (tensile strength and water absorption) of recycle paper and compared with delignified natural rice straw paper.

MATERIAL AND METHOD

Materials

The materials include are rice straw, and 95% NaOH concentration.

Methods

The wastes of rice straw need to be cut into 4-8 cm by using rotary straw cutter to easily milled, and screened before pulping. The soda pulping process was carried out in an electrically heated thermostatically with the

appropriate temperature. Using NaOH concentration (4-10% w/w) and temperature (60-90°C) were diverse in soda pulping process of rice straw. Rice straw was diluted with NaOH solution at a ratio of 1:17 (w/v) in laboratory flask about 1 hour. After obtaining pulp result, it is neutralized by rinsing with water and was added with water to mixing with motor stirrer in 300 rpm. The mixture is poured in a strainer to press and removed excess water. The resulting sheet of paper is then dried in an oven for further characterized by its chemical composition which is cellulose and lignin content while physical characteristics examined which is tensile strength and water absorption.

Additionally, to make recycle paper is same going to the process of soda pulping but there are have many various at a mass ratio of 1:1, 1:3, 1:5, 1:7, and 1:9. It was made by mixing rice straw and used paper or wastes paper. First step of the process is waste paper need to be cut into small pieces and added with water before blended. Rice straw was added with water to blended and mixed with the waste paper that has been blended earlier. The mixture is poured in a strainer to press and removed excess water. The resulting sheet of paper is then dried in an oven for further physical characteristics examined which is tensile strength and water absorption.

RESULTS AND DISCUSSION

Table 1: Delignification Conditions and Result of Pulping Process Including Cellulose and Lignin Content, Tensile Strength and Water Absorption

NaOH (%)	Temp. (°C)	Cellulose (%)	Lignin (%)	Tensile Strength (N/mm^2)	Water Absorption (g/cm^2)
4	90	74.22	5.48	2.14	195.67
6	90	76.84	4.78	2.70	195.03
8	90	79.49	3.96	4.36	193.58
10	90	74.58	4.18	4.18	191.03
8	60	71.66	10.78	1.08	253.96
8	70	73.18	10.16	1.13	220.62
8	80	74.78	9.67	1.18	190.98
8	90	79.38	4.58	3.92	185.67

Result and Discussion

To get the optimal conditions for soda delignification, the sodium hydroxide (NaOH) concentration and temperature were varied. As stated in table, eight studies are listed together with their respective delignification process variables that is the chemical content (cellulose and lignin) and physical characteristics (tensile strength and water absorption).

The first sample has sodium hydroxide (NaOH) at 4% concentration and temperature of 90°C, the cellulose content is 74.22%, lignin at 5.48% with tensile strength 2.14 N/mm2 and water absorption of 195.67 g/cm2. The second sample have NaOH at 6% concentration and temperature of 90°C, the cellulose contents is at 76.84%, lignin at 4.78 with tensile strength 2.70 N/mm2 and water absorption 195.03 g/cm2. For the third sample, NaOH is at the 8% concentration with temperature is still 90°C. The cellulose level is 79.49% and lignin is at 3.96%. The tensile strength for this sample is 4.36 N/mm2 and water absorption of 193.58 g/cm2. As we can see here, the higher the concentration of NaOH, the higher the cellulose content, the lower the lignin content. At the fourth sample, the NaOH is further increase up to 10% with the same temperature of 90°C. The cellulose content is 74.58% with lignin of 4.18%, tensile strength of 4.18 N/mm2 and water absorption 191.03 g/cm2. As we can see here, even the NaOH is being increase from previous sample, the cellulose content drops and the lignin content is increase from before. This conclude that the optimum NaOH concentration is at 8% and any more than that will decrease the tensile strength of the paper.

Next, we will find the optimum temperature for the pulping process. So, for the fifth sample, we use NaOH with 8% concentration but with different temperature that is 60℃. The cellulose content is 71.66% and lignin with 10.78%. The tensile strength is 1.08 N/mm2 and water absorption of 253 g/cm2. The sixth sample use the same concentration of NaOHthat is 8% but different temperature of 70℃. The cellulose content is 73.18% and lignin is 10.16% with tensile strength of 1.13 N/mm2 and water absorption of 220.62 g/cm2. The seventh sample use same NaOH concentration with 80℃. The sample have cellulose content 74.78% with lignin 9.67%. The tensile strength is 1.18 N/mm2 and water absorption is 190.98 g/cm2. For the last sample, NaOH concentration is still 8% but the temperature is increase to 90℃. The cellulose content is 79.38% with lignin 4.58%. The tensile strength is 3.92 N/mm2 and water absorption is 185.67 g/cm2. As we see, the higher the temperature, the better it is for paper as the cellulose content is high, the lignin is low and the tensile strength is high and the water absorption is low.

Figure 1 **Paddy field**

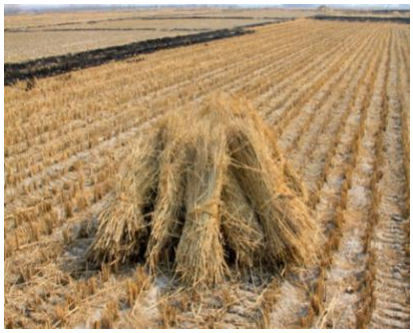

Figure 2 **Rice Straw**

Figure 3 **Paper**

Figure 4 **Corn Straw**

Figure 5 **Grass**

CONCLUSION

As a conclusion rice straw have traditionally been regarded as essentially waste materials of paddy that have a little value. Farmers generally burn the residue in field resulting into severe air pollution and related health problems. But, the research have proven that rice straw composition can be a useful raw material for pulp and paper industry as it is high in cellulose and low in lignin that is good for paper tensile strength. The research also found that for the soda delignification process, the optimum concentration for sodium hydroxide (NaOH) is 8% and the optimum temperature is 90℃. This will produce a good quality paper with tensile strength 4.36 N/mm2. We hope that the usage of rice straw as a paper will be use more in the future as it has a great potential not only for a good quality of paper but also to reduce the over forestation and to utilize waste produce at paddy field as the rice straw is 1/3 of the total production of paddy.

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E-EXTENDED ABSTRACT of the INTERNATIONAL AGROTECHNOLOGY INNOVATION SYMPOSIUM (i-AIS) (2nd EDITION)

e ISBN 978-629 -97220-4-5

9 786299 722045

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(online)

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