

PRODUCTION OF PAPER WITH WATER HYACINTH AND MULBERRY PULP FOR DRIED FRAGRANT FLOWER PACKAGING

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ABSTRACT

This study considered the production of dried fragrant flowers packaging from paper made with water hyacinth and mulberry mixed pulp. Water hyacinth pulp was blended with mulberry pulp and added with chitosan and hercon by coating onto the paper surface. The test results on the properties of dried fragrant flowers packaging made with water hyacinth and mulberry mixed pulp showed that the paper had average thickness of 0.27mm., average weight of 100 g/m², average tensile and yield strength of 7 MPa, average elongation at yield of 3.38%, average tearing strength of 46.08 mN.m²/g., and burst resistance of 3.9 kg/cm²

Keywords: Paper, Water hyacinth, Mulberry Pulp, Packaging

INTRODUCTION

Craft paper or handmade paper is a sheet of material obtained from a combination of one or more kinds of fibers to make into a sheet (Krairoop et.al.,2019) [1]. Most of the fibers include both the long fibers from mulberry pulp and the short fibers from other plants such as bagasse, rice straws, water hyacinths, reeds, and also animal feces, for example. Making craft paper uses the principle of bonding among fibers. After the paper has dried, the quality will decrease and when the paper is exposed to water or moisture it will be torn easily (Wuttinant, 2016)[2] According to the research of Jitlada (Jitlada ,2017)[3] on the development of paper production from coconut husk to community business, the survey of entrepreneurs reported that the thin, unbleached, mixed-pulp paper received most satisfaction and it can be fold to be used for handicrafts and other packaging products. Mechanical property improvement of the coconut husk paper that can be processed into products had extended for community business operation.

Water hyacinth fiber is cellulose natural fiber which can be mostly found on its stem leaf. The fiber consists of a bundle of rod-like fibrils, and its texture is harsh and coarse (similar to flax). It was found that there is 11% by weight of fiber from the total dry weight, with relatively coarse fibers (52 denier), bulk density 1.46, moisture regain 7%, dry strength 2.05 gpd (grams per denier), and wet strength 2.46 gpd. (Werasak, 2011)[4]. Since the investigation of chemical properties of water hyacinth found that water hyacinth is a type of plant that contains cellulose, there is hence a lot more research to make more uses of hyacinth, for example, by grinding and mixing in animal feed making into resin for treating waste water both in the household and in the industrial sector as found such as in dyeing industry and processing as paper. If pulp can be produced from water hyacinth and can be used to make paper to replace the use of mulberry pulp, it will reduce the import from foreign countries and to make use of water hyacinth that can help to considerably reduce environmental problems (Wuttinan, 2012)[5].

Chitosan is a natural extract from shrimp bio waste. Chitosan can make a thin film over other materials. In many cases, it has been shown that chitosan coating will increase the functionality and quality of these materials. In addition, chitosan are high density of positive charge, biodegradable, biocompatible and antifungal. A research to examine the paper coated with chitosan mixed with 1% (w / v) vanillin found an efficacy to inhibit the growth of the fungus better than paper coated with chitosan alone. This is the result of work that enhances co-efficiency between chitosan and vanillin (Ratchadaporn Jaimun, Jurmkwan Sangsuwan, Parinya Chantrasri)[6]. The researcher was therefore interested to examine the properties of water hyacinth pulp and the properties of chitosan in order to improve the properties of handicraft paper for producing dried fragrant flowers packaging in various forms of use such as for souvenirs and for export to generate income for farmers who produce flowers.

OBJECTIVE

1. To make paper from water hyacinth and mulberry mixed pulp for producing dried fragrant flowers packaging.
2. To examine the properties of paper made from water hyacinth and mulberry mixed pulp.

METHODOLOGY

The present study is an experimental study of paper made from water hyacinth and mulberry mixed pulp and coated with chitosan. The blending of 20 kg of water hyacinth leaf pulp and 8 cups of mulberry pulp was prepared to make paper, boiled with 30% concentrated caustic soda (NaOH), and then manually formed into paper using 4 square meshes of 70x75 cm, each with 600 grams of pulp, and dried in sunlight. The 4 resulting sheets of paper were then coated with 1% concentrated Chitosan and let dry. The paper was tested for its various properties and tried out making packaging box.

Figure 1
Stock Preparation and Papermaking



Figure 2
Testing of paper and paper packaging



RESULTS

Result of physical properties test of paper made from water hyacinth and mulberry mixed pulp

Table 1

Properties of dried fragrant flowers packaging from water hyacinth and mulberry mixed pulp

Test	Average
Thickness (mm)	0.27
Weight (g/m^2)	100
Tensile and yield strength (MPa)	7
Tearing strength ($\text{mN}\cdot\text{m}^2/\text{g}$)	46.08
Burst resistance (kg/cm^2)	3.9

Figure 3
Packaging



CONCLUSION AND FUTURE WORK

The The test of properties of dried fragrant flowers packaging from water hyacinth and mulberry mixed pulp suggested that the paper had average thickness of 0.27mm, average weight of $100 \text{ g}/\text{m}^2$, tensile and yield strength of 7 MPa, elongation at yield of 3.38 % , tearing strength of $46.08 \text{ mN}\cdot\text{m}^2/\text{g}$, and burst resistance of $3.9 \text{ kg}/\text{cm}^2$. It agreed to a research by Wuttinant (2012) on mechanical properties of Thai handmade paper from water hyacinth and saa mixed pulp for handicrafts (Wuttinant, 2012)[5]. The ratio of water hyacinth pulp mixed saa pulp at 70:30 gave the best result with mechanical properties of basis weight of $65\pm 5 \text{ g}/\text{m}^2$, brightness of 64.35 percent, smooth index of 5.75 sec, tear index of $32.83 \text{ mN}\cdot\text{M}^2/\text{g}$, tensile index $23.91 \text{ N}\cdot\text{m}/\text{g}$, burst index of $2.46 \text{ kPa}\cdot\text{m}^2/\text{g}$ and folding endurance of 118.44 times.

This study to produce dried fragrant flowers packaging from water hyacinth and mulberry mixed pulp indicated that coating chitosan onto the paper resulted in its increased water resistance while other properties remained the same. Suwankiri found that the products obtained from processing water hyacinth were of 2 types including paper and fabric. For paper, the production process involved boiling the short stem water hyacinth with sodium hydroxide (caustic soda) for about 1 hour in a close system; bleaching the pulp with hydrogen peroxide 5 g/l; adding silicone emulsion binder; and beating pulp in water and slowly taking up the pulp to form in the mesh and letting dry to obtain paper. A research by Pranee Lertsutthiwong [7]

described that chitosan is a natural product which is produced from shrimp biowaste. Chitosan can make a thin film over other materials. In many cases, it has been shown that chitosan coating will increase the functionality and quality of these materials. Chitosan are high density of positive charge, biodegradable, biocompatible and antifungal. It was consistent with a research by Wuttinant to produce handmade paper and improve mechanical properties of paper by chitosan coating to provide paper for handicrafts. The handmade paper was prepared by mixing Jerusalem artichoke pulp with paper mulberry pulp at the ratio of 70 to 30. Jerusalem artichoke pulp was produced by treating Jerusalem artichoke with 35 percent Sodium hydroxide in digester at 170 ° C for 3 h, and the pulp was bleached with 20 %t hydrogen peroxide. Then, the prepared handmade paper was coated with chitosan solution at different concentrations, 0.0, 0.2, 0.4, 0.6, 0.8, 1.0, and 1.2 percent. Paper mechanical properties were measured according to TAPPI standards. The results show that paper coated with 0.6 percent chitosan provided good mechanical properties suitable for handicraft.

Recommendations for further research

1. To form paper by hands, pulp should be evenly distributed all over to obtain even thickness of paper sheet.
2. To form paper packaging box, patterns or colors should be incorporated before forming paper sheet.
3. Study and experiment should be conducted on functional life and use of mixed pulp from other natural materials in making pulp for paper production.

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