CHAPTER I

Introduction

Rationale

Paper is one of our most important industrial products. The invention of paper revolutionized the whole world. Almost everything we see in today's world is made up of paper. Books, magazines and newspapers are printed on paper. Education, government and industry could not operate properly without paper. Aside from using paper for reading and writing, papers are also used in packaging and toweling.

Paper has been the daily demand of people from all walks of life so that it is important to produce paper daily to cope up with the existing demand for it.

The paper making industry rely mainly on trees as the starting material in manufacturing paper. These

trees contain a large percentage of fibers, which is actually the main ingredient in papermaking.

Since these trees are needed daily, we have to log our trees on everyday basis. But we are much eager to save our forests from becoming bare because we all know what will happen next. So it is the proper time to find some alternative raw materials for making paper. This probable alternative should also be a common material.

Since the coconut tree is highly fibrous, it has also been made into paper only on laboratory scale. Comparing the coconut trunk with the coconut husk, both have are fibrous in nature, only that the former is more solidified.

Coconut husks have properties which is similar to trees in terms of papermaking potentials and at the same time, it is cheaper and abundant, so, we therefore chose to use the coconut husks as our raw material for making paper.

Statement of the Problem

1. Can the coconut husks produce paper of the same quality compared to the commercialized paper?

2. Can the coconut husks produce paper in a commercial scale based on its quality, its percentage yield and its productive efficiency?

Objectives of the Study

1. To produce quality paper out of coconut husks.

2. To determine the mass of paper produced per mass of coconut husks used.

3. To help lessen the problem of garbage disposal of the husks.

Significance of the Study

Trees are so common and so important in our daily lives that their absence would be hard to imagine. Without trees, the development of our civilization would have been infinitely slower and our present level of sophistication could not be attained.

Trees provide most of the needs of the primitive man, from hunting tools to shelter. From trees came wood. From wood came ships, houses and buildings, furnitures, and pulp, which is eventually processed to produce paper.

The trees used for making paper are in great danger of extinction. Illegal logging and the apparent "shaving" of the mountains greatly affected the supply of the trees, despite heavy measures to prevent deforestration. Our forests are gradually degraded, with the paper industry as one of its greatest consumer.

The utilization of coconut husks as the raw material for the manufacture of paper is of great help in minimizing forest degradation. It also helped solve the problem of disposal of coconut husks, which are often regarded to as wastes. Though some already make

use of it as fuel, they too can cause destruction through the fumes which are emitted during the husks' combustion, which causes air pollution.

The paper product would also be cheaper, since the materials used are waste products, and in a way, it help to save our trees.

Scope and Limitations

The raw material used in making paper was limited only to coconut husks and this study was conducted within the bounds of the research laboratory of Philippine Science High School Western Visayas.

Hypotheses

1. Coconut husks have the capability of making high quality paper.
2. Paper produced from coconut husks can be available for commercial purposes.

Definition of Terms

COIR

A commercial fiber manufactured from the husks of the coconuts, most of which comes from Ceylon and India.

COCONUT

Fruit of the coconut palm (*Cocos nucifera*) of the family Arecaceae, which grows throughout the tropical regions of the world. The fruit has a large outer husk of fibers, which is split off and used for coconut matting and ropes. Inside this is the nut. Its hard shell contains an edible white fleshy lining and filled with milky juice. Both are very nourishing and palatable.

COCONUT HUSK

A fleshy, outer covering of the coconut shell, in which the coir is derived.

PAPER

A thin, flexible material made in sheets from vegetable fibers (such as wood pulp) or rags and used for writing, drawing, printing, packaging, and various household needs. The name comes from papyrus, one kind of writing material made from water reed, used in ancient Egypt.

PAPER PULP

Material reduced to a soft uniform mass for making paper. It is a soft mass of wood, vegetable, straw, or kenaf fibers used for making paper.

CHAPTER II

Review of Related Literateture

Paper gets its name from papyrus, a reed used by ancient Egyptians for writing. The Egyptians cut papyrus stalks into thin strips and pressed crisscrossed layers of strips to form a sheet.

To be classed as true paper the thin sheets must be made from fiber that has been macerated and beaten until each individual filament is a separate unit. The fibers are then mixed with water, and with a sievelike screen (called the mold), the fibers are lifted from the water in the form of a thin stratum, the water draining through the small openings of the screen. This leaves a sheet of intertwined fiber upon the screen's surface, which, after drying, is a sheet of paper. This is the manner in which Ts'ai Lun, Chinese minister of agriculture, formed the first paper about A.D. 105. At

first, the Chinese used hemp plant or the inner bark of the mulberry tree for fiber. Later, they found that good fibers could be obtained by pounding ropes, rags, or old fishing nets into a sheet. Early Chinese paper was too rough for use in writing, instead, they used it for wrapping and clothing.

The Chinese art of papermaking found its way to the outside world after several Chinese papermakers were captured by the Arabs in what is now called Western Turkestan. The Arabs urged the papermakers to continue making paper and teach it to the Moors in the city of Samarqand. The paper industry was established in Baghdad in A.D. 795. Papermaking spread to Europe as a result of the Crusades and the Moorish conquest of Northern Africa and Spain.

Until the latter part of the 18th century, practically all paper of Occidental origin was made from linen and cotton rags, or a mixture of these fibers. The use of wood as a papermaking material was first idealized by French scientist Rene Ferchault de Reaumur. He observed that the wasps used wood fibers to make their nests, the texture of which resembles that of paper. In 1840, following Reaumur's observations,

Friedrich G. Keller (1816 - 1895), a German, patented a machine for making paper using wood ground into fibers. Since then, people, have been using paper from wood.

Special Kinds of Paper

Various factors determine the properties of a paper. These factors include the type of pulp used, the amount of refining done on the pulp, and the kind of paper machine used. Special additives, as well as treatments given to a paper during or after its manufacture, also affect the finished product.

Newsprint is usually made from a blend of one part chemical pulp for strength and three parts groundwood pulp for a low cost and good printing poperties. Many writing and printing papers are sized to prevent ink from spreding into the paper. Sizing is done either by including certain chemicals in the sheets or by coating the surface of the sheet with a starch solution. Dyes that bind to the pulp fibers produce colored papers. Many magazines and book papers are coated with a mixture of starch solution and clay. The coating becomes glossy when the paper is polished between the rolls of a super

calendar. Paper treated in this way is especially good for printing.

Inexpensive writing papers are made from mechanical pulps. Higher quality paper are chemically treated. Rag pulps produce the finest writing papers.

Toweling and napkins are made from recycled fibers. Papermakers use special additives to give strength to the paper. Most paper bags are made from refined, unbleached Kraft pulps. Kraft pulps are used for food packaging. Cereal boxes, cartons and posterboards are made from recycled newsprint.

Through continued research and development, Forest Products Research and Developmet Institute (FPRDI) had succesfully produced pulp and paper from the coconut trunk. Other products related to paper had also been developed from the coconut trunk.

Other parts of the coconut tree was also tested for chemical properties that are desirable for papermaking. It was found out that the cocout trunk is a promising material for pulp and paper based on fiber length (1.94 mm), flexibility ratio (67) and hollocellulose (66.7). On the other hand, coconut husk is also a promising

material for pulp and paper in terms of flexibility ratio (61) and Runkel ratio (0.64). (Rojo, et. al., 1988)

Pilot plant experiments confirm the laboratory results that stretch paper can be made from coconut coir. But it is found out that on a paper machine, the coconut coir pulp alone could not run. It is necessary to mix a certain proportion of long-fibred pulp. Paper could be made with mixing long-fibred pulp in coconut coir pulp as low as a proportion as 20%. Even on mixing as high as a proportion as 45% long-fibred pulp the stretch of the paper was as high as with 20%. Since the coconut coir is a costly raw material, it can only be considered as raw material for the manufacture of costly special grades of papers where high stretch is required. (Guha and Mathur, 1963)

CHAPTER III

Methodology

Fresh coconut palm (*Cocos Nucifera*) husks were utilized, which were obtained from the disposed coconut husks of coconut vendors in Jaro Market, Jaro, Iloilo City.

Other materials used were two percent (2%) sodium hydroxide (NaOH), two percent (2%) sodium hypochlorite (NaClO), resin and alum (commonly known as tawas). The equipment used were the mold, fine-holed screen, basin, mortar and pestle, rolling pin, and an extra large aluminum pot.

Preparation of the Husks

Fresh coconut husks were peeled off their stiff outer covering to separate the soft and fibrous parts. The husk were sliced 5-10 cm long and washed.

The husks were boiled in the pot containing 2% sodium hydroxide solution, 10 parts of solution to one part of husk, for about two to three hours in medium heat. Afterwhich, it was drained and washed thoroughly.

The resulting product was beaten by the mortar and pestle. The fibers were filtered in a screen with the aid of high pressure water.

The fibres were soaked in a 2% sodium hypochlorite solution, 10 parts of solution to one part fiber for twenty minutes in room temperature. Then the fibers were washed until the last traces of sodium hypochlorite are taken out.

Paper Production

Before the paper was made, the fibres were dipped in water in a 1:9 proportion by mass for about 30 minutes. Then the water was drained and the fibers were made into a ball.

The fibers were again beaten until all coagulations disappeared when it is immersed in water.

The net pulp produced weighed 124.5 grams. The pulp was mixed with 12 grams of resin and 10 grams of alum. The mixture was added to 5% water and 7.5% starch by

mass. The resulting mixture were transferred in a basin and was mixed thoroughly.

The mixture was made into sheets using the mold. The resulting sheet was placed in a cloth and the excess water was squeezed off by the use of the rolling pin. The cloth was taken off and the sheet was hanged to let it dry.

CHAPTER IV

Results and Discussions

The trial paper did not produce an efficient paper due to many reasons. First, the fibers were too thick that proved difficult to be bonded effectively. The mortar and pestle was not effective enough in crushing the fibers thoroughly. Second, the fibers had the tendency to clump making it difficult to make the pulp into a sheet. Finally, the resin, which is supposed to be the binder, did not dissolve thoroughly in the mixture.

There were no quality determination made since there were no paper produced.

CHAPTER V

Conclusion and Recommendation

The feasibility of coconut husk was tested in this study but the results, however, was negative. The major step in this study was the complete grounding of the fibers into very into thin ones, but the apparatus used (the mortar and pestle) have been futile for this purpose. Another problem that caused the failure of this study was the resin, the supposed to be binder of the fibers. It didn't dissolve in the mixture completely, resulting to a half-cooked mixture in which the fibers were not properly binded that the fibers were literally tied in knots.

The researchers recommend that the fibers which is the main raw material be finely pulverized. It is best recommended to use an electric grinder or seek help from experienced millers. Besides, the resin to be used can surely bind the fibers together.

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