



## **Article Review; UTILIZATION OF SEAWEED INDUSTRY SOLID WASTE FOR PAPER RAW MATERIALS**

**by:**

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### **Abstract**

This article aims to examine the utilization of solid waste from the seaweed industry into paper raw materials. Based on the results of the literature study, information was obtained that the waste from the seaweed industry can be used as raw material for making paper. Seaweed waste contains cellulose which is the main raw material for making pulp which is the raw material for paper. The pulping process is assisted by chemicals Chlorine Dioxide (ClO<sub>2</sub>), Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>), and 12% NaOH solution. There are five stages of making paper made from seaweed industrial waste, including mixing raw materials with NaOH solution, washing, filtering, printing to drying to become paper products. The resulting quality is no less good than paper made from wood.

*Keywords: paper, seaweed, waste, utilization*

### **Introduction**

The grass industry that has long developed in the world is the agar extraction industry, the alginate extraction industry and the keraginan extraction industry. The three seaweed industries produce solid waste, namely seaweed dregs.

Seaweed dregs are seaweeds that have taken their secondary metabolites, namely agar, alginate or keragin. So this seaweed pulp is a cell wall that contains cellulose. Thus, this dregs can be utilized into products that are more economically valuable. This article aims to examine the utilization of solid waste from the seaweed industry into paper raw materials.

## Paper

Paper is one of the main needs around the world. The process of making pulp as a raw material for paper today has undergone significant development since the second half of the 19th century, and has developed in a more capital-intensive direction. The pulp industry as one of the raw materials for paper is currently an important sector that contributes huge profits to the national and international economic sectors.

The world's paper needs reach 350 million tons per year. This makes both the pulp and paper industry expand and produce on a large scale to meet product demand. Indonesia is the 12th largest paper supplier in the world. In Asia, Indonesia is the fourth largest paper supplier after Japan, China and South Korea. The world pulp price as of September 2020 reached US\$907 per metric ton, this is a fairly high jump from the previous world pulp price of US\$606 per metric ton. The increase in pulp prices is in line with increasing demand.

The large demand makes pulp production capacity increase. Illegal practices by exploiting natural forests to meet raw materials are also increasingly prevalent. This causes natural damage, one of which is deforestation. Exploitation of forests without replanting or reforestation causes deforestation to increase. According to the Wahana Lingkungan Hidup (Walhi) organization, the national pulp industry needs up to 27.71 million m<sup>2</sup> of wood every year.

The reduced supply of raw materials for pulp production has forced paper producers to seek alternative solutions to replace wood as a raw material for products. Alternative raw materials for making paper are also needed in order to reduce the impact of environmental damage and have the same good quality as pulp from wood raw materials (Wikanaji, 2013).

## Pulp Components

Pulp is a material papermaking raw materials. Pulp is a dry fiber formed through a chemical or mechanical fiber separation process from wood, fiber waste and seaweed alternative waste. Pulp can be in the form of lumps or formed into sheets.

The main raw material for pulping is cellulose. Cellulose can be obtained from fibrous plants. The basic ingredients in the paper industry contain several components, including cellulose, hemicellulose, lignin, and other extractive materials. Seaweed industrial waste can be used as raw material for making paper because it is based on the cellulose content contained in it. The following are the contents of the seaweed industrial waste according to Triwisari (2010).

Content	Quantity (Weight %)
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Cellulose	59.69
Hemicellulose	13.86
Lignin	2.37
Other extractive ingredients	24.05
pH	7.2

With the presence of cellulose in seaweed industrial waste, seaweed industrial waste can be an alternative solution in the manufacture of paper raw materials because as already mentioned, the basic raw material for making pulp which is the raw material for making paper is cellulose content.

**Process for Making Pulp from Seaweed Industrial Solid Waste**

The process of making pulp as a material The raw paper uses two methods, namely the extraction method and the ozone bleaching method and with the help of two types of chemicals, namely Chlorine Dioxide (ClO<sub>2</sub>) and Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>). There are five stages of making pulp as the basic material for paper, which are as follows:

1. Seaweed industrial waste and 12% NaOH solution as solvent were weighed according to what was used for each sample. The raw materials used are 15%, 20% and 25% or 300 grams (15%), 400 grams (20%) and 500 grams (25%).
2. Seaweed waste is heated at a temperature of 100oC until it crumbles and then filtered using wire gauze.
3. The seaweed waste is then washed and rinsed until it dissolves with water.
4. Seaweed waste liquid filtrate was printed, separated and filtered using wire gauze, poured into a 35 cm x 35 cm tin.
5. The pulp dough is dried for 4-5 days until the pulp dough dries and becomes paper sheets at room temperature.

**Quality Paper Made from Plup from Solid Waste from the Seaweed Industry**

Quality paper products with materials The raw seaweed waste produced is of high quality, because the surface is very smooth, white, clean, has a high opacity, making it suitable for the production of thin paper. This is different from paper from wood pulp, which has a rough surface, so you have to use a filler. Seaweed waste pulp has advantages compared to pulp from wood, namely in cooking it only requires water, in the bleaching process it only uses harmless materials, namely ClO<sub>2</sub> and H<sub>2</sub>O<sub>2</sub>, so from a safety point of view it is not dangerous.

## **Market (Price and Market Segmentation) in Indonesia**

In Indonesia, there are 11 agar industries and 14 carrageenan industries (3 refined and 11 semi refined) where their products have become import substitutions and are for export. Indonesia has 14 wood pulp industries with a capacity of 7.9 million tons and 79 paper industries with a capacity of 12.7 million tons. Currently, paper with seaweed waste as raw material is still not widely produced. This has resulted in market segmentation not showing high demand. The production of waste in the seaweed industry for paper raw materials needs to be increased, because this is an alternative paper raw material for the future, which we know that currently deforestation is increasing for the production of paper made from wood.

## **Conclusion**

Based on the results of the literature study, information was obtained that the waste from the seaweed industry can be used as a raw material for making paper. Seaweed waste contains cellulose which is the main raw material for making pulp which is the raw material for paper. The pulping process is assisted by chemicals Chlorine Dioxide (ClO<sub>2</sub>), Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>), and 12% NaOH solution. There are five stages of making paper made from seaweed industrial waste, including mixing raw materials with NaOH solution, washing, filtering, printing to drying to become paper products. The resulting quality is no less good than paper made from wood. The advantages of paper made from seaweed waste are that this paper is very safe, not easily torn, and environmentally friendly.

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