

DEVELOPMENT OF ADULT DIAPERS AND BANDAGES USING NATURAL FIBRES

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Introduction:

Areca husks are commercially zero value products that do not have significant nutritional value to serve as nutrition for other crops. They are often used for the curing of roads. This project aims to add value to the areca husks by making them into biodegradable and eco-friendly product. It may be used as a substitute to currently existing absorbent material to make adult diapers and bandages among other applications.

Objectives:

- Screening and selection of natural fibres from various sources
- Processing and characterization of selected natural fibres
- Development of spreadsheet with super absorbent
- Designing and development of diapers and bandages

Methodology:

Step 1: Selection of natural fibres

Areca fibres were selected out of the five products which were: Banana fibres, agave fibres, coconut fibres, bamboo fibres.

Step 2: Collection of samples

Samples were collected for two weeks from two places to compare the quality of raw materials

Step 3: Drying and separation

The areca fibres were dried for one week and the husk was separated from the shell.

Step 4: Moisture test

Dry areca husk is tested for absorbance and the value is found out to be 39.83%

Step 5: Chipping

The areca husks were sent through the chipper and small chips were obtained from all three samples (Raw form, husk fibres and shells).

Step 6: Ash analysis

The chips were kept in a muffle furnace for 730°C for 60 minutes. The ash content of the material was analysed for Iron, Calcium and Silica concentration.

Step 6: Cooking

All three types of fibres were weighed and 112g (taking 10% correction for moisture) of fibres and 390 ml of water in a bomb which were then fitted into an autoclave digester unit for 90 minutes at 160°C, the bath inside the autoclave digester is filled with PEG (Poly Ethylene Glycol) due to the high temperature required for the cooking of the fibres. Cooking is done to soften the fibres and encourage high absorbance. PEG has a high boiling point of 200-300°C and is therefore used in this process.

Step 7: Draining the Pre-Hydrolysis (PH) liquor

PH liquor (Pre-Hydrolysis) is the liquid present after cooking the fibres in the above mentioned method. This is drained to check the hemicellulose content and this is then pumped into the biogas plant for biogas manufacturing.

Step 8: Cooking with White Liquor

White liquor which contains Na_2S , NaOH , Na_2CO_3 is added to the bomb and kept in the autoclave digester for 35 mins.

Step 9: Draining Black Liquor

Black liquor which majorly contains the lignin present in the fibres, is drained and washed with DM water from the bomb and pumped into boiler for heating purposes.

Step 10: Disintegration and straining

The pulp after straining is loaded into a disintegration jar and it is disintegrated at 5000 rpm for two runs. This disintegrated pulp is then strained and washed. The solid material left behind is called unbleached pulp.

Step 11: Bleaching

The unbleached pulp is bleached first with H_2SO_4 to reduce to pH to 2.6. Then it is further bleached with ClO_2 as initial treatment for 90 minutes at 70°C in water bath. The pulp is strained and washed with DM (De-Mineralized) water. The washed pulp is treated with Caustic Lye (NaOH) for 90 minutes at 70°C in water bath. After straining and washing, the pulp is treated with Sodium Hypochlorite (NaClO) for 90 minutes at 70°C in a water bath. The pulp is washed and strained after which, it is treated again with Sodium Hypochlorite at 70°C for 90 minutes in a water bath.

Step 12: Sheet making

The bleached pulp is then converted into sheets by using vacuum chambers. The sheets are then dried in a hot air oven or sheet drier for 5-10 minutes.

Step 12: Diaper and bandage making

A CAED diagram of the intended size of diapers and bandages are designed and cut out of dressing sheets. The dried areca husk sheets are alternatively placed with cotton pads and super absorbent material (SAM) in the pre-cut sheets and embossed to seal the material inside.

Results and Conclusions:

Areca husk fibres extracted from the Areca nut were successfully converted into absorbent sheets and later made into adult diapers and bandages having comparable absorbance capability as the commercially available diapers. In conclusion, Areca husk fibres offer great absorbance and strength and are a possible substitute to currently available diapers. The sheets produced are eco-friendly and biodegradable and hence are a sustainable option in the future.

Scope for future work:

During the course of our project, we found various areas of improvement as standardization of pulp production process from areca husks, possible strength and durability increments to the sheets, incorporation of super absorbent material (SAM) into the sheets. Other applications for the areca husk sheets would be handmade paper for novels or diaries.