

SOLVENT EXTRACTION OF OIL PALM BIOMASS USING THE ALCELL® PROCESS

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JUNE 1999

90

PORIM TT No. 67

PORIM INFORMATION SERIES

ISSN 0128-5726

The paper industry uses large and expensive equipment. For example, the cost of a single paper machine complex runs close to US\$300 million and a fully-integrated bleached kraft pulp and paper mill costs almost US\$1.5 billion.

Such capital requirement for the construction of a conventional pulp mill has caused many investigators to take a fresh look at solvent pulping. This is so because the production of papermaking fibres particularly from non-woody plants can be carried out in lower cost facilities.

Building upon the expectation of lower capital, PORIM and Repap Enterprises Incorporation of Canada have undertaken collaborative research on solvent pulping of oil palm biomass using the ALCELL® process. Pre-hydrolysis of oil palm biomass to extract the hemicellulose in the form of sugars enhances the subsequent removal of lignin with organic solvents. As a result, oil palm biomass is separated into three major constituents consisting of hemicelluloses which are water soluble, lignin which is soluble in organic solvent, and cellulose which is water insoluble.

PROCESS DESCRIPTION

Solvent extraction of oil palm materials were carried out in a batch pressure reactor operated at 185°C. Immediately after charging, the feed was subjected to three displacement stages using aqueous ethanol liquors containing dissolved solids of progressively lower content. Cooking mainly occurred in the primary stage while the

tertiary stage functioned mostly for extraction and washing. After the tertiary stage, the resulting pulp was discharged and washed counter-currents with ethanol and water.

The liquor from the primary stage was acidified to precipitate the lignin as a fine particulate dispersion. Alcohol was concentrated in a distillation column while furfural was recovered from a furfural-rich stream tapped off from the reactor section of the column. Figure 1 illustrates the principle of the ALCELL® process.

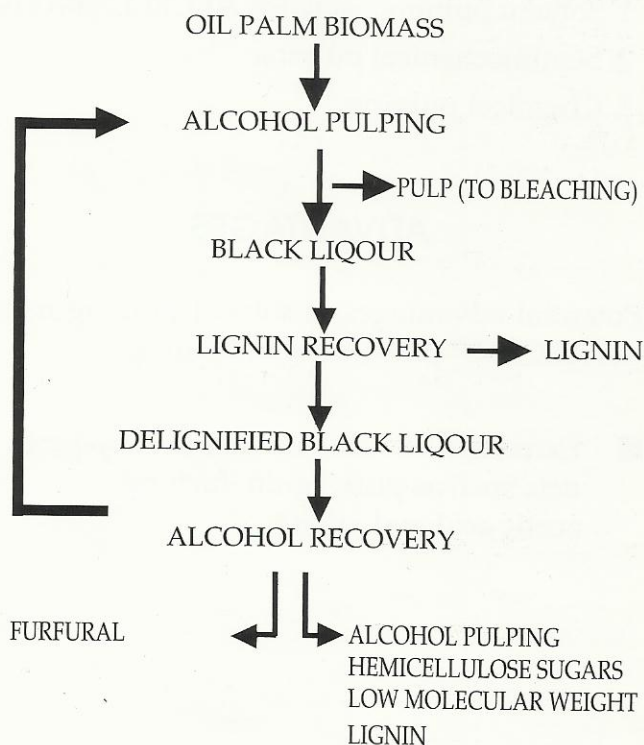


Figure 1: Technology principle of ALCELL® process.

ISSN 0128-5726



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PROPERTIES OF PAPER HAND SHEET MADE FROM PULP OF DIFFERENT PULPING PROCESSES.

The strength properties of paper hand sheets made from EFB pulps of different pulping processes are summarised in *Table 1*.

TABLE 1. THE STRENGTH PROPERTIES OF PAPER HAND SHEETS MADE FROM EFB PULP OF DIFFERENT PULPING PROCESSES.

Properties	Types of pulping process		
	Solvent extraction ¹	CTM-Pulp ²	Sulphate pulp ³
Tear factor (mNm ² /g)	-	-	100.00
Breaking length (km)	3.6	-	4.2
Folding endurance (number)	61.0	61.0	250.0
Tear Index	5.3	10.4	-
Tensile index	36.9	28.8	-
Burst factor	23.9	-	-
Bleached pulp yield (%)	70.0	50.0	45.0

1. Solvent pulping using the ALCELL[®] process
2. Semimechanical pulping
3. Chemical pulping

ADVANTAGES

Potential advantages of solvent pulping using the ALCELL[®] process are as follows:

- Extraction of valuable chemical by-products such as pure lignin, furfural, acetic acid and xylose,

- Higher yield of pulp (up to 52%),
- A reduction of bleaching cost due to easy bleaching nature of the pulp,
- Economic viability of lower capital cost (US\$266/tonne) and smaller mills (58,000 tonnes/annum),
- Minimal environmental impact, with no odour and minimal effluent, and relatively a simple recovery system.

ECONOMIC FEASIBILITY

The manufacturing costs of pulp produced from solvent pulping using the ALCELL[®] process are comparable (US\$266/tonne) to those of the Brazilian Bleached Kraft Pulp (BKP) (US\$267/tonne) and the Indonesian BKP (US\$240/tonne).

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