

Carbon black is very fine carbon powder used mainly in rubber and automotive products, such as hoses, gaskets and coated fabrics. It is also used in inks and paints, plastics and in the manufacture of dry-cell batteries. Partial combustion of furnace oils, obtained from petroleum refining, is used to produce carbon blacks (furnace blacks). In this technology, *furnace black* is produced from empty fruit bunch (EFB) by Kraft pulping (chemical activation) of the carbon pre-cursors of EFB before carbonization. The aim is to extract the lignin via a non-pulping process for carbonization which reduces the chemicals and energy required. Lignin has both phenolic and alcoholic hydroxyl groups and a variety of inter-unit linkages; hence, it is suitable substrate carbon black and carbon fibres preparation (Kubo *et al.*, 1998).

Lignin is a complex lignocellulose constituting about 14% to 22% (dry weight) of plant cell walls. There are three major groups based on their structural monomer units - Coniferyl alcohol, Sinapyl alcohol and *p*-Coumaryl alcohol (Figure 1) (Sarkanen and Ludwig, 1997).

MPOB technology for Kraft pulping of oil palm biomass was presented in Transfer of Technology No. 47, in which was stated that EFB produces the best Kraft pulp (Kamaruddin *et al.*, 1997). Kraft pulping involves digesting EFB in white liquor (sodium hydroxide and sodium sulphide) at 165°C for 3 hr. The process yields almost 45% pulp and the lignin containing wastewater called *black liquor*.

## PREPARATION OF CARBON BLACK

In this present technology, lignin is extracted by digestion of pre-carbonized EFB chips using the same chemicals for Kraft pulping but at a lower temperature of 120°C. This is because in the pre-carbonization process, the hemicellulose and extractives and part of the cellulose have been pyrolysed, hence, lower temperature suffices for the extraction (Byrne and Nagle, 1997). This also means that Kraft lignin can be obtained without having to depend on the pulp and paper industry. The resulting mixture is then filtered to separate the black liquor (Figure 1) from the black solid residue. The solid residue is used immediately to prepare activated carbon, while the black liquor is processed for Kraft lignin.

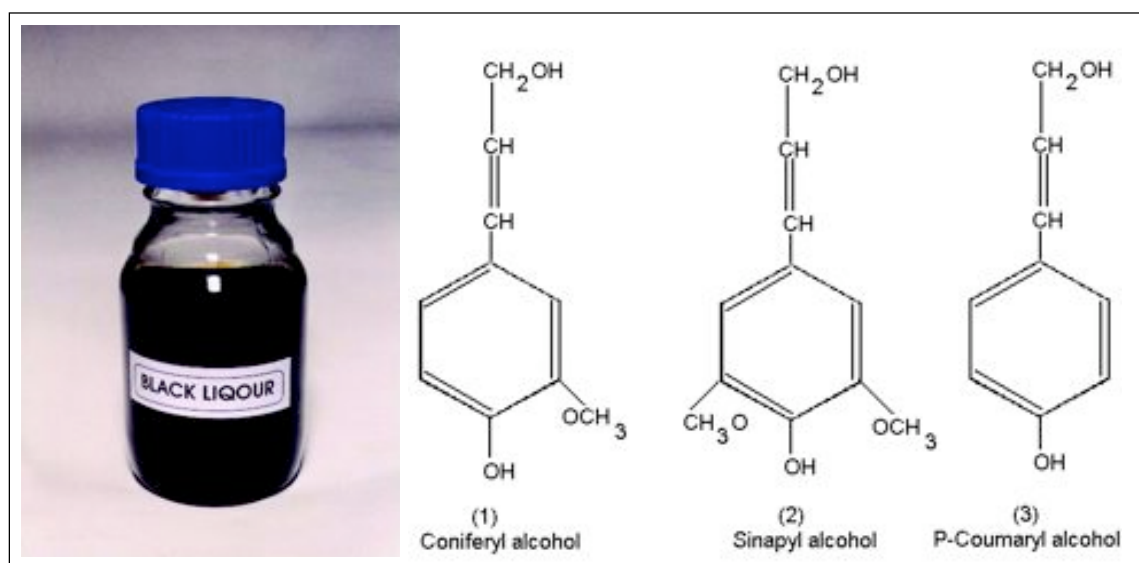


Figure 1. The black liquor and monomers of lignin.

Lignin is recovered from the black liquor by either ultra-filtration or CO<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub> precipitation. The liquor is concentrated to 25%-30% solid content and the lignin precipitated with H<sub>2</sub>SO<sub>4</sub>, filtered off and dried. The dried lignin is then carbonized at 1000°C in nitrogen using a specific heating profile.

### **ECONOMIC FEASIBILITY**

In the present Kraft pulping, almost all the lignin is burned for recovery of the pulping chemicals and generation of energy. But an economic evaluation has found that 21% of the lignin can be used to produce value-added products (Davy *et al.*, 1998). This is proposed in this technology, which will reduce the operation cost, hence, reduce the selling price of the carbon black. Selling the Kraft lignin for other products will also contribute to the cost-effectiveness of the process.

### **CONCLUSION**

A non-pulping process for Kraft lignin extraction is proposed, hence, the economies extraction and use of the Kraft lignin.

### **REFERENCES**

- BYRNE, C E and NAGLE, D C (1997). Carbonization of wood for advanced materials applications. *Carbon*, 35: 259-266.
- DAVY, M F; ULOTH, V C and CLOUTIER, J N (1998). Economic evaluation of black liquor treatment processes for incremental Kraft pulp production. *Pulp & Paper Canada*, 99(2): 35-39.
- KAMARUDDIN, H; MOHD BASRI, W; MOHD NASIR, A; JALANI, S; ARIFFIN, D and RIDZUAN, R (1997). Pulp and paper from oil palm fibres. *PORIM TOT No. 47*.
- KUBO, S; URAKI, Y and SANO, Y (1998). Preparation of carbon fibres from softwood lignin by atmospheric acetic acid pulping. *Carbon*, 36(7-8): 1119-1124.
- SARKANEN, K V and LUDWIG, C H (1997). *Lignin: Occurrence, Formation, Structure and Reactions*. Wiley-Interscience, New York.

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