545d A Novel Process for Separation of Lignin from Kraft Black Liquor

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Lignin is, after cellulose, the second most abundant component of wood. It is an energy-rich, very complex random natural polymer that consists mainly of cross-bounded phenyl propane units. In the pulping industry, vast amounts of lignin are separated from wood and are, except for a very marginal quantity produced for specialty chemical purposes, burned internally in the pulp mill to produce steam and electricity for the process. For external purposes, lignin can still be considered an untapped resource, bound to become increasingly important in a society less dependent on fossil fuel.

In the dominating kraft pulping process, accounting for more than 60% of world pulp production, black liquor, consisting of dissolved lignin, other wood components and spent pulping chemicals, is burned to recover energy and pulping chemicals. This internal combustion makes a modern pulp mill self-sufficient in terms of steam used. With increasing energy optimization an energy surplus is attainable in the pulping process, especially for market pulp mills, but also for those integrated pulp and paper mills where the recovery boiler is a bottleneck for increased pulp production. This means that the dissolved wood components in the black liquor contain more energy than what is necessary in the process. To make efficient use of this energy surplus is an important issue for the pulping industry and the society, both from environmental and economic standpoints.

One attractive option is to separate lignin from the black liquor. The lignin can, after post-treatment, be exported in form of a solid bio material or be used internally in the pulp mill lime kiln or in the bark boiler. Kraft lignin has a number of potentially very important short-term and long-term applications, both for CO2-neutral fuel purposes (in gaseous, liquid or solid form), “green” materials (e.g. carbon fibers, plastics) or “green” chemicals (eg. different phenols). In practice, this separation is conducted by acidifying the black liquor with carbon dioxide, thus precipitating the lignin. Thereafter, the resulting suspension is filtered and the lignin filter cake washed. The traditional separation concept is considered to be difficult with filterability problems, large lignin yield losses and a lignin product with low purity as a result.

In this paper, a novel method of separating lignin from kraft black liquor is presented, and its effects on the pulping process discussed. This method was evaluated in laboratory scale, bench-scale and finally in small pilot scale trials. During the pilot-scale test run in September 2004, approximately 8 tonnes lignin with a heating value of 20-23 MJ/kg (dry) and high purity (0.02-0.4 % Na on dry weight) and dry solids content (61.5 % in average) was produced.