ENGINEERING AND ECONOMIC FEASIBILITY OF LARGE-SCALE BIOPULPING TRIALS

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ABSTRACT

Biopulping, defined as the treatment of wood chips with lignin-degrading fungi prior to pulping, is very effective for mechanical pulping. The fungi, which are natural wooddecay organisms, appear to alter the lignin in the wood cell walls, and have the effect of "softening" the chips. This substantially reduces the electrical energy needed for mechanical pulping, reduces the cooking time for sulfite pulping, leads to improvements in paper strength properties, reduces the pitch content of wood, and also is environmentally sound. Nine years of consortium research has demonstrated the technical feasibility of the technology on a laboratory scale.

Our recent work involved scaling up the biopulping process towards the industrial level, investigating both the engineering and economic feasibility of the technology. We envision the process will be done in either a chip pile or a silo-based system for which several factors need to be considered. These factors include the necessary degree of decontamination of the wood chip surface. maintaining a hospitable environment for the fungus to be effective, and the overall process economics. At the Forest Products Laboratory (FPL), we have demonstrated the feasibility of the process at a 4-ton and at a 40-ton level with equipment designed and constructed at FPL. In the larger, outdoor trial, chips were processed continuously for over 20 hours at a throughput of nearly 2 tons per hour. A brief low-pressure steaming of chips was sufficient for decontamination. Furthermore, a simple, forced-ventilation system maintained the proper temperature, humidity, and chip moisture content resulting in uniform growth of the fungus throughout the pile. Refining the treated chips (thermomechanical pulping) resulted in energy savings of about 30% compared to the untreated chips. Economically, this translates into art overall saving of $9 to $23 per ton of pulp in a chip-pile based system. These savings increase considerably when the increased throughput allowed by the reduced energy needs is also considered. These cost savings do not include the other benefits listed above that biopulping confers. Taking these factors into account would increase the savings even further. Thus, the biopulping technology appears to be feasible from both engineering and economic standpoints.

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