

Introduction to the Agenda 2020 Next Generation Chemical Pulping Subgroup

BY PETER W. HART

The Next Generation Chemical Pulping Subgroup of Agenda 2020 is a committee of industrial representatives that has been tasked with identifying the next major research projects and pathways required to enable breakthrough improvement within the pulping area. The goals of the team are to identify new approaches for delignifying wood and preparing fiber for bleaching and papermaking that reduces energy and capital demands, improves yield, and preserves fiber strength and end-use attributes. Ideally, the new process would represent a substantial change in energy (-25%), pulp yield (+5%), process (capital intensity change such as elimination of kiln/recaust; elimination of sulfur), or exhibit a 25% reduction in effluent biochemical oxygen demand/chemical oxygen demand (BOD/COD) over an existing best available kraft pulping process. Through a series of face to face meetings and conference calls, the team identified four major areas for further research focus: wood chip activation, catalysis, high kappa pulping, and solvent pulping.

Wood chip activation

Wood chip activation was determined to be a potential area for exploration because reducing energy, operating costs, and capital intensity are some of the highest priorities that the pulp and paper industry needs to address. Improving the reaction rate and selectivity of chemical pulping should reduce these costs. Initial pretreatment attempts have included green liquor and biological pretreatments of wood. The former approach has demonstrated incremental production/yield increases of 3%-5% over conventional kraft pulping [1-4]. Jacobs et al. demonstrated that a hemicellulase and cellulase pretreatment on sycamore wood chips resulted in pulps with higher brightness and enhanced bleachability compared to the control kraft pulps [5]. A recent patent by Nippon Paper has reported that a hot water treatment of Eucalyptus woodchips enhanced kraft delignification by 40% at equal effective alkali (EA) charges [6]. The areas for potential research in this area that have been identified include catalytic peroxide treatment via in-situ generated peracetic acid (application alkaline peroxide to react with acetate groups in softwood hemicellulose), near neutral mild

chip treatment with oxidizing additives, and supersaturated oxygen treatment in NaOH produced in-situ.

Solvent pulping

Solvent pulping was identified as an area that has undergone extensive research efforts, with several different processes being taken to pilot or commercial scale. These pilot or commercial processes include autohydrolysis (Alcell process), acetic acid pulping, the Milox Process, the Organosolve Process, alkaline sulfite anthraquinone methanol (ASAM) process, and the ammonium sulfide ethanol and water pulping process. None of these processes was able to obtain economic or safety requirements for complete large scale commercial operation due to insufficient recovery processes. If a solvent pulping process is going to develop in the future, significant research effort will be required in this area of the process.

High kappa and catalytic pulping

The remaining two areas for research, high kappa pulping and catalytic pulping, have been fully developed into three distinct review papers included in this issue of *TAPPI Journal* (*TJ*). One paper reviews the lifecycle of anthraquinone (AQ), the only successful, long term pulping catalyst (p. 23). This paper evaluated the reasons that AQ was not more widely adopted by the industry in an effort to identify potential downfalls associated with catalytic pulping.

Another paper in this issue of *TJ* reviews the state of the art and current active research areas associated with catalysis (p. 13). Potential areas for further research have been identified. A third paper in this issue reviews the state of improved yield in both brown and bleached fiber associated with high kappa pulping (p. 33). Required research needs have also been identified for this line of research.

In addition to the three detailed papers in this issue of *TJ* and this synopsis of ongoing work, an introductory editorial and an R&D fact sheet prepared by Ron Brown, past Executive Director of the Agenda 2020 program, have also been included (p. 5, 10). The fact sheet details the long term potential wood and energy savings available through the development of new and improved pulping processes, details potential benefits from transformational change, highlights

benefits from public funding of pre-commercial research and development programs, and puts forth potential areas of focus for these research programs.

The Next Generation Chemical Pulping Committee has developed the current state of the art of the chemical pulping industry and justified a detailed set of research needs and potential directions for the future. **TJ**

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