371f A Process for Refining Biomass into Value-Added Products

Kiran L. Kadam, Richard Wingerson, and Ed Lehrburger

A biorefining process will be discussed for converting agricultural residues and other biomass feedstocks into value-added products such as fuel ethanol and market pulp. This closed-loop biomass fractionation technology relies on an extruder apparatus that minimizes reagent and water use and accomplishes biomass fractionation in a relatively short time compared to traditional biomass pretreatment or pulping processes. The process being developed dissolves and separates hemicellulose and lignin from biomass in sequential stages, leaving relatively pure cellulose. Enzymatic hydrolysis of this cellulose stream requires significantly lower enzyme loadings for hydrolysis with a corresponding reduction in production costs. The hemicellulosic sugars captured in the hydrolyzate liquor and cellulose-derived glucose can be used to produce ethanol and other industrial chemicals. Alternatively, the cellulose fraction can be sold as agri-pulp, which in contrast to kraft pulp, is produced without adding sulfur or chlorine-containing chemicals. This pulping option produces a higher value commodity than ethanol and, unlike ethanol, does not need additional processing such as hydrolysis or fermentation. The resultant lignin is highly reactive and can be used for value-added products or for on-site co-generation of steam and electricity. This paper will discuss process development efforts—using corn stover as a feedstock—in terms of operational challenges, product yields, process efficiencies, and quality of cellulose produced both as a fiber source and as a substrate for enzymatic hydrolysis for sugar production. Engineering, economic and scale-up issues in the framework of commercialization will also be discussed.