**Omnivorous Biomass Fractionation based on SO2-Ethanol-Water Pulping as part of a Lignocellulosic Biorefinery**

*Dr. Adriaan van Heiningen*

University of Maine, Department of Chemical and Biological Engineering

FiDiPro Professor, School of Science and Technology, AALTO University, Espoo, Finland

**ABSTRACT**

Lignocellulosics are considered as feed stock for transportation fuels and chemicals because they address two pressing global issues; climate change and “peak oil”. The collection and processing of wood at centralized facilities is already practiced by the forest products industry. Therefore, the production of renewable and carbon-neutral biofuels and chemicals besides traditional products such as paper, tissue, board and wood products also presents a great opportunity to the forest products industry to improve its profitability. Since the market for transportation fuels is an order of magnitude larger than the pulp market, these new products will have a lower price than pulp. Therefore at the present time the new products should be produced from the non-cellulose part of the wood chips or from additional biomass. To minimize capital and operating cost, the scale of the lignocellulosic biomass conversion should be maximized and closely integrated with pulp production. Also the biomass fractionation process must be omnivorous process and simple in order to minimize operating and capital costs.

The AVAP® process which uses SO2-ethanol-water to fractionate lignocellulosics in hemicellulose sugars, degraded cellulose and sulfonated lignin may satisfy these requirements. The absence of a base (Mg, Na, etc) reduces the recovery of SO2 and ethanol to simple absorption, distillation and washing unit operations. Also, the absence of bisulfite in the fractionation solution avoids degradation of the dissolved sugars. The presence of SO2 eliminates troublesome lignin-based precipitates, hydrolyzes the hemicelluloses, and allows fractionation of a mixture of lignocellulosic biomass, including softwoods. At the same time the presence of ethanol leads to rapid impregnation of the biomass, thereby avoiding energy consuming size reduction unit operations and allowing high space velocity in the fractionation reactor. The science as well as some techno-economics of this promising omnivorous fractionation process will be discussed. Results to produce butanol from the conditioned hemicellulose fraction will be presented.