

## Development of Biobased Products

Bio-based product development is an old concept that is rapidly expanding and entering new levels of commercialization. The current goal is economic and renewable suites of products from new biorefineries, which will include production of primary products and co-products together. The primary bio-based products can include oils, commodity or specialty chemicals, and materials. Combined with power and fuel ethanol, bio-based products are critical for enhanced value in the various mixed product streams envisioned emerging from either current agricultural products, agricultural and forest residues; or direct biomass crops. This session, organized by Dr. David Glassner (Cargill Dow, Minnetonka, MN) and Dr. Todd Werpy (Pacific Northwest National Laboratory, Richland, WA) focused the oral session on examples of methods to capture this potential mix of products.

Kyle Beery of Archer-Daniels Midland Company gave a progress report on a hydrolysis sugar platform from corn fiber. Key issues were hydrolysis methods, inhibitors, and the variability of corn fiber. David Glassner of Cargill Dow presented a corporate vision of a sustainable industry building on their lactide fermentation platform. Their 400 million lb/year lactic acid plant is under construction with a planned start date in early 2003. Kevin Gray of Diversa Corporation spoke of novel genetic techniques including gene shuffling to harness the broad diversity that exists in culture libraries. In particular, he spoke to issues of improving functional hydrolytic enzymes (e.g., cellulases and xylanases) for biomass conversion. Brian Carr of Athenix Corporation also spoke on the power of genetic engineering, rational genomics and screening to improve biomass conversion and enzymes.

Curtis Scharf of Terresolv Technologies focused on another bio-based platform—vegetable oils. He reported on properties development and formulations to allow expanded uses of biodegradable bio-based oils as lubricants that can match or exceed petroleum oil properties. James Barber of Metabolix then reported on polymer production (polyhydroxyalkonates)

by fermentation or, ultimately, directly in genetically engineered plants. Glucose can also be thermochemically converted by hydrogenation into sorbitol, followed by dehydrogenation into isosorbide, another renewable monomer. Dennis Magyar described DuPont's process for this conversion, emphasizing the importance of purification at each step. The process is operating in France to make polyethylene isosorbide terephthalate where the isosorbide ratio can allow varied properties.

The oral presentations were followed by 20 posters covering other aspects of bioproducts and biorefineries. These included process integration, economics, life-cycle, and biorefinery modeling and assessment. Bioproducts ranged from ethanol, glycerol, propandiol, bio-octane, lactic acid, acetic acid and PHAs as well as amino acids and specialty materials.