NEBRASKA CENTER FOR ENERGY SCIENCES RESEARCH

Cycle 10
January 2016

Investigator: David Berkowitz

Position Title: Professor

Department: Department of Chemistry

Email: dberkowitz1@unl.edu

Phone: (402) 472-2738

Webpage: http://chem.unl.edu/david-berkowitz

Toward High Value-Added Products from Lignin: A Hybrid Chemo/Biocatalytic Approach

Abstract.

Lignocellulose represents a high value biopolymer available in Nebraska in immense quantities. However, the lignin fraction is largely discarded or burned. With the increasing development of biorefineries that convert cellulosic biomass into liquid biofuels, the projection is that a large stock of excess lignin will be generated, much more than is needed to power these biorefineries. The *Grand Challenge* associated with redirecting this large stock of excess lignin toward value-added products is discussed in the May 16, 2014 issue of *Science* (http://www.sciencemag.org/content/344/6185/1246843).

We propose to capture the inherent value of lignin as a complex oxygenated aromatic polymer through its transformation into enantioenriched, value-added building blocks for the chemical industry and pharma. The focus will be on (**Objective 1**; collaboration with N. Bowden) the improved fractionation of lignin monomers by exploiting poly(dicyclopentadiene (PDCPD) membrane technology and their deployment (**Objective 2A**) for the efficient synthesis of new chiral building blocks for polymers and (**Objectives 2B & 2C**) for the synthesis of high value intermediates toward pharmaceuticals. This will be achieved by remodeling the active site of the key CaADH enzyme via the direct interplay of synthetic chemistry and protein crystallography (collaboration with M. Wilson)/molecular modeling (**Objective 3**). The technology under development should be scalable once the boundary conditions are established. It anticipates the refocusing of the DOE's Energy Efficiency & Renewable Energy (EERE) Division on co-product strategies to achieve bioenergy technology success and will likely attract external industrial interest. The project has important relevance to the goals of sustainable energy production by offering a biorenewable approach to value-added platform chemicals as an alternative to the fossil-derived petrochemical approach currently used.