

Cycle 5 – Energy Research Grants

Generation of Biomass-Derived Feedstocks for Biofuel and Bioenergy Production

Principal Investigator:

Jiantao Guo, Assistant Professor

Chemistry

402-472-83525

www.chem.unl.edu/faculty/eachfaculty/guo.shtml



ABSTRACT

Unlike fossil fuels, which come from biological material that grew millions of years ago, biofuels are produced from plants grown today. The overall process of biofuel production is relatively simple: it involves the breakdown of cellulosic materials of plants to release fermentable sugars, which are then fermented to create fuel. However, the challenge is how to do this effectively.

The goal of the research is to develop efficient and cost-effective procedures to generate biomass-derived feedstocks for biofuel and bioenergy production. Specifically, cellulosome, which is used by anaerobic bacteria and fungi, will be engineered for the highly efficient degradation of plant cellulosic material. To fully realize cellulosome's potential in the degradation of cellulosic material for biofuel and bioenergy production, the mechanism of cellulosome assembly and the synergistic action among catalytic subunits in cellulosome will be fully investigated. In cellulosome, the random attachment of a given catalytic subunit is mediated by the specific interaction of its dockerin domain with any one of the cohesin domains of scaffoldin. In the research, orthogonal cohesin-dockerin pairs will be generated by protein engineering and used to precisely assemble catalytic subunits at prearranged positions. This will allow the creation of artificial cellulosomes that can be used to achieve highly efficient degradation of cellulosic material.

These studies could make a major impact on the fields of biotechnology, such as in the current efforts to develop efficient and cost-effective procedures for biofuel production from the abundant plant lignocellulosic biomass.