Biological Upgrading Of Hemicellulose Derived Xylose

As changing climates, resource scarcity, and policy drivers force society toward a future based on renewable resources, technical efforts must be made to achieve the best possible use of all resources. The highest value use for lignocellulosic biomass is achieved through a biorefinery where lignocellulosic biomass is broken into its substituents. While the cellulose and lignin portions (roughly 50% and 25% dry wt. respectively) of biomass have well defined end uses, a high value or high demand use for hemicelluloses (25% dry wt.) derived from lignocellulosic biomass in a biorefinery has yet to be found. These hemicelluloses could be biologically upgraded to lipids by microalgae and subsequently converted to biodiesel. Recent work has shown that many species of microalgae, such as *Chlorella protothecoides*, can produce lipids at very high yield and that some species can grow heterotrophically on xylose (a five carbon sugar derived from the hydrolysis of the hemicellulosic fraction of lignocellulosic biomass). Near infrared (NIR) absorbance will be used to monitor sugar concentrations in growth media while Nile red fluorometry will be used to monitor lipid concentrations. By tracking the lipid productivity and growth rate of heterotrophic *Chlorella protothecoides* in a variety of nitrogen and xylose conditions, this work will identify the optimal conditions under which xylose derived from hydrolyzed hemicelluloses could be biologically upgraded to lipids and eventually biodiesel.

Keywords: biodiesel, algae, biofuel, xylose, biorefinery, lipids, renewable fuel