U.S. DEPARTMENT OF ENERGY
AlgaePrize
NextGen Algal Innovators

Team Name:

Parachlorella Plastic Pals

Team School/Organization:

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Abstract:

The ongoing depletion of fossil fuels has directed research toward development of eco-friendly, renewable materials to replace petroleum plastic products. While recycling technologies have been suggested as the key solution to this crisis, the reality is that less than 5% of plastics are recycled and the remainder are often incinerated or tossed in landfills. Polyurethane (PU) plastics are among the most adaptable and broadly utilized materials due to their chemical composition. Thermoplastic polyurethanes (TPUs) consist of three key chemical compounds: diacids, diols, and diisocyanates. Previous work has demonstrated that these monomers can be produced from bio-based sources (corn, castor beans, and soybean), however these feedstocks are not ideal as they require arable land, potable water, and compete with consumer food production. Historically, fatty acids from algae have been used for biofuel production, but we want to explore higher value products by utilizing these fatty acids to synthesize renewable TPUs. Microalgae can generate high densities of biomass and lipids without the need for additional resources associated with crop growth. We, the Burkart lab at UC San Diego, have demonstrated the ability to synthesize diacids and diisocyanates from algae oil, but not much work has been achieved on production of short and long chain diols from microalgae. For this project, we plan to create 100% algae-based, biodegradable TPUs comparable to industrially available TPUs. Our focus will be on three main areas: algae productivity, downstream processing of algae oil to short and long chain diols, and the formulation and characterization of polyurethane products.