Algenesis Inc.
DE-FOA-0002638 Control number 2638-1564

SUMMARY FOR PUBLIC RELEASE

Project title: Pre-Pilot Scale Production of Algae-based Jet Fuel and Polyurethane Monomers
Topic Area: Pre-Pilot Scale-Up of Integrated Biorefineries
Subtopic Area 1b: Pre-Pilot Scale-Up of Integrated Biorefineries: Use of Carbon Dioxide from Ambient Air in Algal Systems
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For algae-derived biofuels to be cost-competitive with fossil fuels, the algae industry must invest in the production of secondary high-value products and markets that will allow for monetization of the entire algae biomass. Commodity products, like fuels, also require large scale production so that economies of scale can be achieved that will enable reduced fuel prices. At Algenesis, we have developed sustainable and biodegradable algae-based polyurethanes derived from algae biomass. These high value petroleum replacement co-products will enable economic production of algae biofuels, while also addressing our plastic waste problem. We have developed algae-derived polyurethanes that can be used to manufacture consumer products, including flip flops, shoe midsoles, foam sheeting, and PU-coated fabrics. These products presently contain up to 60% bio-based content and meet or exceed commercial performance metrics. Because these bio-based polyester polyurethanes have chemical bonds that occur in nature, the resulting polyurethanes are biodegradable, and we have demonstrated that they are able to biodegrade in soil, compost, and sea water. Some of these products, such as our plant-based Blueview^{Tm} Pacific shoe, have entered commercial production and are already available to consumers on our fashion brand website blueviewfootwear.com.

The goal of our project is to continue to develop a circular carbon economy that replaces the petroleum-based chemicals in consumer products with algae-derived and biodegradable polymers. Under this project we will demonstrate a scaled supply process for generating polyurethane monomers at sufficient quantity to produce a line of prototype consumer products with our corporate partners. We will valorize the economic production of algae-based biofuels and de-risk the mass manufacturing of algae-based polyurethanes, and associated consumer products. To accomplish this, we propose to: 1) Develop a refining process that utilizes differential precipitation (winterization) of crude algae oil, derived from biomass grown utilizing direct air capture, to separate saturated and unsaturated fatty acids; 2) Chemical processing of the recovered fatty acids into biofuels (saturated FA) and polyurethane precursors (unsaturatedFA); and 3) Production of ASTM certified renewable jet fuels and finished polyurethane products that meet industrial standards, from these precursors.

A significant impact of this project will be the demonstration of commercially-relevant technologies and finished products that will enable the economic production of algae-based renewable fuels and bio-based polyurethanes. Finished prototype products will demonstrate the technology, and are essential to the continued advancement of the algae biofuel and bio-products industry, by providing a key milestone for the entire algae bio-products industry. Key project partners include Corning, Trelleborg, BASF, and Global Algae Innovations, each of whom have direct stakes in the outcomes of this project. Successful completion of this project will enable our retail partners to enter the market with algae-based polyurethanes in as little as two years, setting the stage for the production of algae-based polyurethanes for use in sports equipment, food packaging, and even construction and industrial processes.