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Impact of Bioplastic Co-Product Production on Algal Biorefinery Sustainability

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Sustainability of Algal Biorefining: Potential of Integrating Bioplastic Production

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Abstract:

Algae biomass has the potential to replace significant amounts fossil fuels through the production of biofuels. One major hurdle to the implementation of biofuels produced from algae has been the high price of these fuels. Hence, a major topic in the algae research sector has been the increased utilization of co-products. These additional value co-products such as animal feed, specialty chemicals, and nutraceuticals greatly increase the value of the algae biomass, reducing the cost of the produced fuel. One co-product sector that has been under explored is bioplastics. Since bioplastic production requires only the protein content of the algae, a fractionation process matches up well with the implementation of bioplastic production. Bioplastics can replace multiple products, including flexible foam, synthetic films and imitation fibers, food packaging, mulch, 3-D printing filament, and others. These products range in value from 0.3-4 $/lb, much higher than other protein uses typically investigated. This project leverages engineering process models to analyze the potential improvements in GHG emissions (g CO_2 eq/ MJ), net energy ratio, and cost of fuel production ($/gal) from including bioplastics as a co-product. Sub-process models are validated with experimental work across the entire algal value chain. Experimental data was obtained from a fractionation and growth data specific to fule-gas fed biomass. Modeling work compares traditional processing with the integration of a bioplastic revenue stream. Results show over 90% of facility revenue would come from bioplastic sales, meeting sustainable cost and renewable fuel standards.

***Keywords**:* Algae, Bioplastics, Sustainability, Biofuels, Co-products