U.S. DEPARTMENT OF ENERGY AlgaePrize NextGen Algal Innovators

Team Name:

AlgaeUnlocked

Team School/Organization:

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Abstract:

Microalgae have attracted considerable global interest over the years because of their renewability, sustainability, and potential economic advantages to human civilization—on or off planet Earth. As autotrophs, microalgae can sustainably fix atmospheric carbon dioxide, generating an array of useful cellular products. Utilization of microalgae for agriculture and biofuel technologies are of specific interest as an environmentally friendly alternative to current reliance on fossil fuels and chemical agricultural additives. However, current methods for microalgae pretreatment and downstream processing are energy-intensive and cost prohibitive, presenting significant challenges that prevent the full "unlocking" of algae's potential.

Southern Illinois University Carbondale and spin-off company Thermaquatica Inc. have developed and patented a technology called Oxidative Hydrothermal Dissolution (OHD). The OHD process uses only heat, water, oxygen, and pressure, to dissolve virtually any biomass—e.g., algae—into a non-toxic, aqueous solution of low MW organic products. The conversion efficiency is ~90% with a quick contact time of 20–30 seconds. Microalgae's infamous resistance to lysis/downstream processing is unlikely to be a problem due to the physical and chemical nature of the OHD method. Thus, significant pretreatment obstacles that have prevented the full realization of microalgae's economic and commercial potential (e.g., cracking and dewatering) can be bypassed. The resulting dissolved microalgal biomass will be biochemically and chemically available for applications that would unequivocally demonstrate the viability of pairing this new technique with the microalgae industry. We propose to explore the use OHD-processed microalgae in the two most economically important applications, generating biostimulants and biofuels.