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Short Communication

Biodiesel from mixed culture algae via a wet lipid extraction procedure

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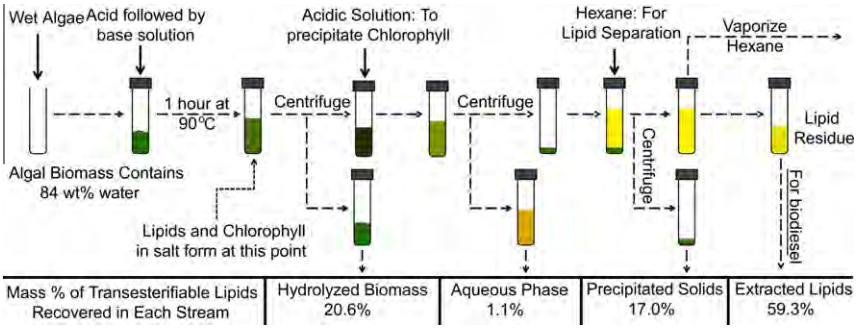
HIGHLIGHTS

- Procedure developed for extraction and isolation of lipids from wet algal biomass.
- Up to 59% of the transesterifiable algal lipids are isolated from wet algal biomass.
- Removal of chlorophyll by precipitation prior to lipid isolation.
- Procedure generates feedstock material for production of additional bioproducts.

GRAPHICAL ABSTRACT



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ABSTRACT

Microalgae are a source of renewable oil for liquid fuels. However, costs for dewatering/drying, extraction, and processing have limited commercial scale production of biodiesel from algal biomass. A wet lipid extraction procedure was developed that was capable of extracting 79% of transesterifiable lipids from wet algal biomass (84% moisture) via acid and base hydrolysis (90 °C and ambient pressures), and 76% of those extracted lipids were isolated, by further processing, and converted to FAMEs. Furthermore, the procedure was capable of removing chlorophyll contamination of the algal lipid extract through precipitation. In addition, the procedure generated side streams that serve as feedstocks for microbial conversion to additional bioproducts. The capability of the procedure to extract lipids from wet algal biomass, to reduce/remove chlorophyll contamination, to potentially reduce organic solvent demand, and to generate feedstocks for high-value bioproducts presents opportunities to reduce costs of scaling up algal lipid extraction for biodiesel production.

1. Introduction

Dependence on petroleum based fuels is not sustainable due to increasing fuel costs, steady depletion of crude oil, and the environmental consequences associated with the use of fossil fuels (Chisti, 2007; Schenk et al., 2008; Demirbas and Fatih Demirbas, 2011). One option for the production of renewable liquid fuels is biodiesel from microalgae to offset usage of crude oil based diesel (Demirbas and Fatih Demirbas, 2011). Microalgae possess advantageous characteristics that warrant its consideration as a source of alternative oil for biodiesel production, as well as a feedstock for the production of additional biofuels and bioproducts (Mata et al., 2010; Christenson and Sims, 2011).

Processes exist for the extraction and/or conversion of algal oils to biodiesel including organic solvent extraction, super-critical fluid extraction, and direct transesterification (Ehimen et al., 2010; Gong and Jiang, 2011). Solvent based lipid extraction and direct transesterification techniques are inhibited when performed in the presence of a water phase (Ehimen et al., 2010; Griffiths et al., 2010). However, dewatering and drying algae is both costly and energy intensive (Molina Grima et al., 2003; Lardon et al., 2009). Traditional solvent based lipid extraction procedures also

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