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Microalgae: A Potential Candidate for Biodiesel

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COLUMN ARTICLE

Modern way of life intimately depends on fuels that are derived from fossil resources. However, high energy prices, global warming, burgeoning population and uncontrolled urbanization are drawing considerable attention to find alternate renewable biofuels. Biodiesel derived from oleaginous microorganisms, renewable biomass, organic matter could minimize the use and reduce the dependency on fossil fuel. It is eco-friendly, non-toxic, bio-degradable, stable, reduces the level of potential or probable carcinogens and has a favourable emission profile [1]. The tantalizing ability of oleaginous microorganisms such as fungi and microalgae with 20% or more lipids in their cell mass have emerged as a potential feedstock for biodiesel production [2-4]. It reduces the overall production costs of biodiesel in the global market, which is the major reason for researchers focusing their attention on oleaginous microorganisms. Furthermore, it could aid to curtail the use of unsustainable fossil fuel, thereby reducing global warming and harmful GHGs emission [5,6].

Microalgae comprises several groups of unicellular, colonial or filamentous, photosynthetic or heterotrophic micro-organisms containing chlorophyll and other pigments. Several benefits can be envisioned from microalgae due to their advantages over higher plants such as similarity in fatty acid profiles with plant seed oils, easy to grow, simple cultural conditions and consistency of the product yield [7]. In 1978, the first large-scale collection and screening of oleaginous algae was started, when the Aquatic Species Program launched by U.S. National Renewable Energy Laboratory for production of biodiesel. After eight years of effort, over 3000 strains were collected and eventually around 300 species were identified as oleaginous algae [8].

Microalgal species can be induced to accumulate substantial quantities of lipids thus contributing to high oil yield [8-10]. Average lipid content ranges between 1% - 70%. However, under certain physiological conditions few species can reach upto 90% of dry weight [3,7,11].

Many attempts have been made to commercialize microalgal biofuels [12,13]. However, reducing low-cost microalgal biodiesel requires primarily improvements in algal biology through genetic and metabolic engineering. Stability of engineered strains and methods for achieving stable production in industrial microbial processes are known to be important issues . In addition, there is a pre-requisite to identify possible biochemical pathways that triggers lipid accumulation and manipulation of gene expression through metabolic engineering can alter both the composition and the quantities of lipids that might favour accumulation of oil [14,15]. Therefore, further research in the development of novel upstream and downstream technologies is warranted for the overall commercial production of biodiesel from microalgae.

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