Algal biofuels: A sustainable pathway to mitigate energy demand

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Algal fuels are generating considerable interest around the world. These fuels may represent a sustainable pathway for helping to meet the energy demand. Algae is a preferred biodiesel base because algae grow more rapidly and occupy less space compared to other plants used for biodiesel such as corn, soy, canola and other lipid producing organisms. The algae strain, *Chlorella vulgaris*, contains 30% lipids by mass. Thus, a common goal is to create a manageable and cost effective process for manufacturing biodiesel on a large scale. Microalgae are single-cell, photosynthetic organisms known for their rapid growth and high energy content. Some algal strains are capable of doubling their mass several times per day. In some cases, more than half of that mass consists of lipids or triacylglycerides—the same material found in vegetable oils. These bio-oils can be used to produce such advanced biofuels as biodiesel, green diesel and green oil[1]. Algae consume carbon dioxide as they grow, so they could be used to sequester CO_2 being released from power stations and other industrial plant that would otherwise go into the atmosphere. Meeting the world's fastly growing energy demands will require a multitude of sources. Several private and government agencies are putting efforts to reduce capital and operating costs and make algae fuel production commercially viable. The challenges that need to be addressed are, the exploitation of naturally occurring photosynthetic microalgae, which provides a green and renewable resource of feedstock biomass to meet increasing energy needs and especially the demand for liquid fuels thereby isolation, screening and evaluation of naturally occurring algal strains which exhibit high growth rate and large-scale photo bioreactor design and optimization, to outdoor mass culture and downstream processing. Challenges to be addressed include refinement of the cultivation process, downstream processing of biomass, and development of an economic feasibility model for commercialization of algae-based biofuels and biomaterials.

[1]. Lianna Costantini, Ellie Johnson and Haley London. Report on Micro Algae-Based Biodiesel. Rose-Hulman Institute of Technology, Terre Haute, Indiana, by Group 1, July 1, 2010.

Evidence for increased Southern Ocean waters in the tropical intermediate Indian Ocean during the last deglaciation

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Oxygen isotopes ($\delta^{18}O$) and Mg/Ca in the *Globigerinoides ruber* (w) are analysed from the Bay of Bengal and Andaman Sea sediments. Mg/Ca, Cd/Ca and B/Ca are also determined in *Cibicidoides wuellerstorfi* and *Uvigerina peregrina* in two cores from the same basins. Furthermore, neodymium isotopic ratios (ε_{Nd}) of seawater in two sediment cores are determined. Our results show that seawater oxygen isotope values were most enriched between 17.8 and 14.6 ka. We also find coincidence between the onset of intermediate water warming at 17.8 ka, and the onset of increase in atmospheric CO_2. In the tropical Indian Ocean, the deep water (>2,200 m) warmed after the surface, in sharp contrast with the warming found in the intermediate water which occurs earlier. Furthermore, an inverse relationship between the intermediate and surface waters is also found during the Bolling-Allerod and Younger Dryas periods in which surface water warmed (cooled) and intermediate water cooled (warmed). We hypothesize that the cause of warming of the northern tropical Indian Ocean intermediate water does not lie within the tropics, rather an increase in Southern Hemisphere spring insolation combined with sea-ice albedo feedbacks, consistent with the hypothesis suggested earlier. The hypothesized mechanism involves an increase in upper circumpolar deep-water circulation into the Indian Ocean.

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