**Global Contribution of Seaweed Culture to the Carbon Cycle**

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**Abstract**

The world uses 15 million tons of fresh (2.3 million tons dry) seaweeds. Seaweed dry weight contains above 30% carbon. Reported carbon content in *Porphyra* is 39%, and in *Undaria* and *Laminaria* 30% (Chung, 2008). Thus, the data in Table 1 imply that nearly 0.7 million tons C y-1 are removed from the sea in commercially harvested seaweeds. Consideration of the scale of seaweed production in some selected countries (Table 2) indicates the extent to which their current production might contribute to any offset against their CO2 emissions. With current levels of production this represents, for most countries, only a small proportion of C emissions. However, it should be noticed that most countries produce little seaweed given the length and character of their coastline. China produces ~116 tons dry seaweed y-1 km-1. If other countries were to match this level, then some at least would be in a position where seaweed utilization could offset significant fractions of their C emissions (Table 1). Of course, culture of seaweeds on huge rafts in the open ocean (Notoya, 2010) can dwarf even this estimate.

Seaweed carbon could make an important contribution to the global production of biofuel. The lipid content of most seaweed species is less than 7%. However, the content of soluble and structural carbohydrates often surpass 30% (Renaud and Luong-Van, 2006). Seaweed lipid can be directly converted to biodiesel with basically the same technology as other biomass feedstocks. Seaweed carbohydrates and proteins can also be processed to useful fuels and chemical feedstocks (Petrus and Noordermeer, 2006).

Seaweed oil is an interesting sustainable feedstock for biofuel / biodiesel manufacturing. It is a next-generation alternative to land based biodiesel sources, like soybean, canola and palm. Seaweed oil can be extracted, processed and refined for various uses, including transportation, using currently available technology. Other benefits of seaweeds as a potential feedstock are their availability. Seaweeds can be grown nearly everywhere. One of the technical challenges for algae based biodiesel is the matching of seaweed growth requirements, performance and chemistry to each potential cultivation site and industrial use. Developing cost-effective engineering of very large scale farms and their operation are additional keys to success in seaweed based biofuel.

Seaweed farms are expected to locate mainly in two environments, one being on the high seas (Notoya, 2010) and in low value coastal lands and waters close to CO2 - emitting industrial centers and power plants. Typical coal-fired power plants emit flue gas with up to 13% CO2. This high concentration of CO2 can enhance uptake of CO2 by some seaweeds. Therefore, where the necessary low value area is available, the concept of coupling a coal-fired power plant with an algae farm provides an elegant approach to the immediate recycling of CO2 from coal combustion into a useable liquid fuel.

**Key Words**: Seaweeds, IMTA, biogas, global warming.