Biofuels and Fertilizers Utilizing Filamentous Algae: A Proposal for a Globally Regenerative Business With Reduced Production Costs

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The overuse of fossil fuels and nitrogen fertilizers presents a significant environmental burden, necessitating sustainable alternatives. While mainstream algal biomass fuels derived from microalgae have a high production cost of $6/L, those derived from filamentous algae have a lower production cost. Filamentous algae, mainly Spirogyra, require no special cultivation equipment and have high vitality, making mass cultivation easy. This project offers a solution to above problems by using filamentous algae as biomass fuel and fertilizer from extraction residue. An open-type culture experiment was successfully conducted for 1 year using iron as the primary nutrient. Monthly cultivation measurements demonstrated that filamentous algae could multiply 85-fold within 1 year. The solvent extraction and combustion experiments revealed that the oil content rate in filamentous algae, which can be used as fuel, ranged from 1.8% to 4.1%. With 20 ha of cultivation area managed per person, production costs can be reduced to $1/L. The post-extraction residue was highly effective as fertilizer for various plants, and component analysis confirmed substantial levels of nitrogen, potassium, and phosphorus. Unlike nitrogen fertilizers, fertilizer made from filamentous algae is environmentally friendly as it leaches less nitrogen. Fertilizer sale has demonstrated its demand. Thus, this project could generate $1.7 million in annual revenue on each hectare. Moreover, if cultivated on 280,000 ha of Japan’s fallow fields, global nitrogen fertilizer consumption could be reduced by 47%. This regenerative business utilizing filamentous algae can reduce greenhouse gas emissions and promote sustainable agricultural practices globally, while also generating significant economic benefits.

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