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Production of Liquid Biofuel from Algae

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Abstract: Biodiesel has gained much attention in recent years due to its eco-friendly nature, non-toxic characteristics, biodegradability and lower net carbon cycle compared to conventional diesel fuels. In the first step, oil from algae specie was extracted using Petroleum Ether as solvents, while in the second stage; extracted oil was converted into biodiesel. The effects of solvent to oil ratio, size of algal biomass and contact time were studied on the percentage yield of oil extracted. Renewable, carbon neutral, transport fuels are necessary for environmental and economic sustainability. The maximum extracted oil was 220ml by using a blend of solvent at solvent to biomass ratio of 10:1, approximately algal biomass size of 0.4 mm and contact time of 30, 12 and 11 mins.

Keywords: Algae, biodiesel, biomass, renewable energy

1. INTRODUCTION

Algae or microalgae is sunlight-driven cell factories that convert carbon dioxide to potential biofuels, foods, feeds and high-value bio actives and as nitrogen fixing bio fertilizers. This article focuses on algae as a potential source of biodiesel. Algae can provide several different types of renewable biofuels. These include methane produced by anaerobic digestion of the algal biomass. Biodiesel derived from algal oil. Biodiesel is produced currently from plant and animal oils, but not from microalgae or algae. This is likely to change as several companies are attempting to commercialize algal biodiesel. Biodiesel is a proven fuel. Technology for producing and using biodiesel has been known for more than 50 years. Other sources of commercial biodiesel include canola oil, animal fat, palm oil, corn oil, waste cooking oil jatropha oil. The typically used process for commercial production of biodiesel. Production of methyl esters, or biodiesel from algal oil has been demonstrated.

2. EXPERIMENT

2.1. Collection and pretreatment of algae specie

The algae samples were collected from our university ponds. The samples were spread under sun in an open area for 48 hours to evaporate the amount of water associated with biomass. The dried samples were grinded, and the fine powder was passed through a 500 micron sieve, to remove the oversize particles. This step is necessary, to get smaller size particles which will have a physical contact with the solvent used for extraction. Figure 1 showed grinding of algae.

Figure 1. Grinding of algae

2.2. Treatment with Solvent

30 gram of grinded algal biomass was treated with 300 ml of Petroleum Ether. Solvent petroleum ether was used for the extraction of oil from algal biomass. The results are shown in Table 1. The mixture was kept at room temperature for 30 mins. A layer of oil on the solvent surface was formed, which was separated from the residue. Flow chart of Extraction of oil from algal biomass are shown in figure 2.

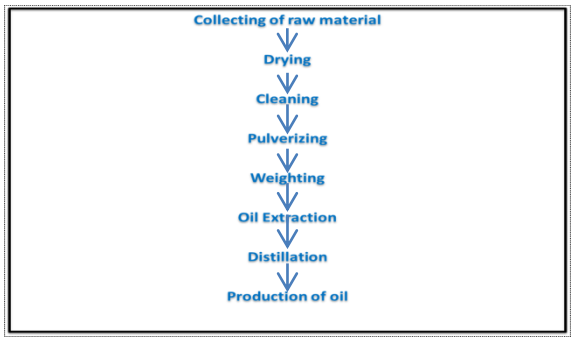

Figure 2. Flow chart of Extraction of oil from algal biomass

2.3. Oil extraction method

Oil extraction from algae biomass was performed in a Soxhlet apparatus using petroleum ether as solvent with sample pre-treatment during 40 min. Soxhlet extractor is a laboratory

apparatus designed to extract substances with a low solubility in the extracting solvent. Figure 3 showed Soxhlet extraction method. Figure 4 showed Petroleum Ether solvent.

Figure 3. Soxhlet extraction method

Figure 4. Petroleum Ether solvent

2.4. Product collection system

The products from the algae are mainly liquids. The algae oils are collected by beaker and then stored in the sample bottles. Figure 5 showed product collection system for soxhlet extraction method.

Figure 5. Product collection system for soxhlet extraction method

3. RESULTS AND DISCUSSION

Table 1. Amount of oil extracted using solvent

Sr No.	Algae, g	Petroleum Ether, ml	Oil, ml	Temperature, ˚C	Time, min
1	30	300	220	40-60	30
2	30	300	220	40-60	12
3	30	300	220	40-60	11

Table 1 showed Amount of oil extracted using solvent. According to their various conditions, it is effect of solvent to algae ratio, size of algal biomass, contact time on the amount of extracted oil, reaction temperature also affects the amount of biodiesel production. The temperature was varied from 40 to 60 ˚C. Reaction is carried out near the boiling point of methanol under atmospheric conditions. It was observed that higher temperature favors the biodiesel production. In this study, maximum biodiesel produced at 60 ˚C, which is in agreement with the available literature. The reaction time for this study was varied between 11 to 30 minutes and it was observed that the yield increases as the reactants spend more time in the reacting vessel.

4. CONCLUSION

Algae was successfully used as a raw material for biodiesel production. Higher algal to solvent ratio, smaller biomass size and longer contact time will enhance the yield of extracted oil. Technology based in these microorganisms currently represents an opportunity for GHG reduction from anthropogenic activities. Biofuels as biodiesel, bioethanol, bio-oil, bio-hydrogen or biogas can be produced. Algae biomass can be used as feedstock for bio-refineries to produce different kinds of products (energy, food, plastics, and fertilizers). Algae appear to be the only source of renewable biodiesel that is capable of meeting the global demand for transport fuels.

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