Evaluation of Sewage Sludges as a Potential Biodiesel Source

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1. RESEARCH BACKGROUND

Biodiesel is promising renewable energy that can be directly used without prior modification of the engine and provides lower gaseous pollutant emissions. The challenge of the biodiesel industry is related to the high cost of vegetable oils as the main feedstock. This reason has turned the researchers toward the utilization of low-cost feedstock. Sewage sludge is generated abundantly from wastewater treatment plants (WWTPs). As the WWTPs continued their wastewater treatment process, much of sewage sludge will be produced, therefore it will be required to find more solutions to convert the wastes into harmless and useful substances. In this study, the potential of using sewage sludge as a lipid source for biodiesel production was investigated by conducting lipid extraction and biodiesel synthesis. The results of lipid and biodiesel yield are used to estimate the annual biodiesel production of sewage sludges based on the sludge generation.

2. METHODOLOGY

The experiments were conducted using seven types of sludges collected from three different WWTPs. The samples were characterized by applying several techniques, such as volatile matter and ash content; Total Organic Carbon (TOC); and C, H and N elements. The lipid extraction of sludge was conducted using Soxhlet extraction. the extracted lipid was converted to biodiesel using an acid-catalyzed esterification/transesterification. Finally, biodiesel synthesized from sewage sludge was analyzed by GC-MS to determine the fatty acid methyl esters (FAMEs) content and biodiesel yield.

3. RESULTS AND DISCUSSION

Among the seven types of sludges, primary scum achieved the greatest lipid and biodiesel yield, a maximum of 29.9 % and 8.12 % respectively. The methyl ester produced from sludges was composed mainly of oleic acid (C 18:1n9c), linoleic acid (C 18:2n6c), and linolenic acid (C 18:3n6) with minor saturated components such as stearic acid (C 18:0), and palmitic acid (C 16:0). Based on the sludge flowrate, primary sludge achieved the greatest amount of lipid potential and biodiesel yield about 2,044 mg/m^3-influent and 383 mg/m^3-influent. The annual estimation of biodiesel potential derived from primary sludge and primary scum was 35,089 and 7,097 ton/year, respectively. Although primary scum has a lower lipid potential based on the sludge generation, it could be more feasible to be used as a feedstock, considering it can be recovered easily from the primary tank of the wastewater treatment system without interfering current scenario of WWTPs process. The efficient recovery of the scum could be an opportunity as a potential revenue source.