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Biodiesel Fuel Properties of Mixed Culture Microalgae under Different CO_2 Concentration from Coal Fired Flue Gas

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Abstract : Biodiesel is an alternative to petroleum-derived fuel mainly composed of fatty acid from oleaginous microalgae feedstock. Microalgae produced fatty acid methyl esters (FAMEs) as they can store high levels of lipids without competing for food productivity. After lipid extraction and esterification, fatty acid profile from algae feedstock possessed the abundance of fatty acids with carbon chain length specifically C16 and C18. The qualitative analysis of FAME was done by cultivating mix microalgae consortia under three different CO_2 concentrations (1%, 3%, and 5.5%) from a coal fired flue gas. FAME content (280.3 µg/mL) and productivity (18.69 µg/mL/D) was higher under 1% CO_2 (flue gas) as compare to other treatments. Whereas, Mixed C. (F) supplemented with 5.5% CO_2 (50% flue gas) had higher SFA (36.28%) and UFA (63.72%) which improve the oxidative stability of biodiesel. Subsequently, low Iodine value (136.3 gI_2/100g) and higher Cetane number (52) of Mixed C.+P (F) were found to be in accordance with European (EN 14214) standard under 5.5% CO_2 along with 50mM phosphate buffer. Experimental results revealed that sufficient phosphate reduced FAME productivity but significantly enhance biodiesel quality. This research aimed to develop an integrated approach of utilizing flue gas (as CO_2 source) for significant improvement in biodiesel quality under surplus phosphorus. CO_2 sequestration from industrial flue gas not only reduce greenhouse gases (GHG) emissions but also ensure sustainability and eco-friendliness of the biodiesel production process through microalgae.

Keywords : biodiesel analysis, carbon dioxide, coal fired flue gas, FAME productivity, fatty acid profile, fuel properties, lipid content, mixed culture microalgae
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