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Application of face centered central composite design in optimization of subcritical water mediated extraction of lipid from activated sludge

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Bioenergy such as biodiesel and renewable diesel can be produced from lipid extracted from a microbial biomass known as activated sludge. At the moment, low lipid yield from activated sludge compared to cooking oil and animal fat seems to affect its application in bioenergy production. There is need to find an optimization technique and extraction method which has the capacity to increase the lipid yield. In this study, subcritical water was used to break the cellular structure of activated sludge in order to release its lipid content. Face centered central composite response surface design was used to optimize lipid yield. The biomass was recovered from activated sludge slurry collected from a sewage treatment work in the UK. Subcritical water mediated extraction using activated sludge was carried out in a semi batch reactor, after which lipids were extracted from the products recovered. Lipids were characterized by high temperature gas chromatography using authentic standards. Statistical analysis of face centered central composite response surface suggested a quadratic model with R-squared 0.9444. The analysis of variance (ANOVA) showed that the model was significant and lack of fit was insignificant. The lipids from the extraction products showed a variation in the profile obtained. The maximum lipid yield 41% was obtained at the optimum conditions of temperature 80oC, time 20 min and biomass loading 1%. The lipid yield when compared to that obtained from solvent extraction without subcritical water treatment and optimization was almost seven times higher, thus offering a greater potential for renewable bioenergy production.

Biography

Ifeanyichukwu Edeh is a Lecturer at the University of Port Harcourt, Nigeria. He is a Petroleum Technology Development Fund (PTDF) Ph.D Scholar and a member of the Supercritical Fluid Technology Group at the University of Birmingham, UK. His research interest is in the area of using state-of-art technology to produce bioenergy from waste materials. He is almost completing a research work on "A critical evaluation of utility of subcritical water to support the production of biodiesel and renewable diesel from lipid fraction of activated sludge" at the University of Birmingham. He has published many papers in reputable Journals.

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