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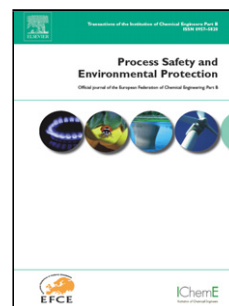
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Disintegration of Palm Oil Mill Effluent Organic Solids by Ultrasonication: Optimization by Response Surface Methodology

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Highlights

- Ultrasonication conditions for POME treatment were optimized using RSM.
- Ultrasonication improved solubilization of POME and increased SCOD concentration.
- Optimum solubilization and SCOD were 16.91% and 33297 mg/L, respectively.

Abstract — Palm oil mill effluent (POME) is a complex wastewater that consists of high concentration of chemical oxygen demand (COD) and insoluble organic solids. Anaerobic digestion has been successfully used in treating POME due to its low cost and ability to produce biogas. Nevertheless, biogas production can be enhanced by increasing the solubility of organic compounds during anaerobic treatment. To improve organic matter solubilization in POME, this study focuses on investigating the applicability of low frequency ultrasonication as a pretreatment to anaerobic digestion. Experiments were statistically designed by central composite design (CCD) and response surface methodology (RSM) was used to examine the impacts of independent variables (i.e., ultrasonication density, ultrasonication time and total solids concentration) on treatment performance in terms of organic matter solubilization and concentration of soluble chemical oxygen demand (SCOD). Analysis of variance (ANOVA) showed both models to be significant with $\text{Prob}>F < 0.01$. The coefficient of determination (R^2) values were greater than 0.80, implying satisfactory agreement between the quadratic models and the experimental data. The optimum ultrasonication performance was obtained at 0.88 W/mL ultrasonication density, 16.20 min ultrasonication time and 6% total solids concentration. This resulted in 16.10% organic matter solubilization and increased SCOD from 29000 mg/L to 31675 mg/L. The differences between the predicted and experimental values were less than 5%. This supports the successful use of CCD and RSM for the design of this set of experiments and determination of optimum responses.

Keywords: *Organic Matter, Palm Oil Mill Effluent, SCOD, Solubilization, Ultrasonication*

1. Introduction

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