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The Optimization of Biodiesel Synthesis From Used Cooking Oil Using Ozone Technology

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Abstract

The utilization of used cooking oil for synthesis of biodiesel has attracted many researchers. However, there is little attention focused on the use of ozone technology for synthesis of biodiesel from used palm cooking oil. Biodiesel in this research is a mixture of methyl esters derived from used cooking oil and methanol with the utilization of acid catalyst and the injection of ozone gas into the reactor. Response surface methodology was applied to determine the optimal operating condition in the biodiesel production. The influence of input variables temperature, ozone concentration, molar ratio of reactant and reaction time on methyl ester concentration was quantified and the optimal condition was indicated by high content of short chain and long chain methyl ester products. The synthesis of biodiesel/methyl esters was conducted in a batch reactor equipped with reflux condenser and potassium iodide trap. A central composite design with four independent variables and two response variables was performed to determine the influence of independent variables. There are two simultaneous reactions occurred, ozonolysis and transesterification reactions. Ozonolysis reaction produced short chain methyl esters consists of methyl hexanoate, methyl octanoate and methyl nonanoate whereas transesterification reaction produced long chain methyl ester products which were methyl palmitate, methyl stearate, methyl myristate and methyl laurate. The optimal operating condition was identified to be a reaction temperature of 35°C; 4.8% ozone concentration; molar ratio oil: methanol of 1:7; and 5 hours reaction time.

Key words: Biodiesel, Ozonolysis, Transesterification, Methyl Ester, Used Cooking Oil