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Optimization of Hydrodynamic Cavitation Process of Biodiesel Production by Response Surface Methodology

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Abstract

The aim of this research was to investigate the optimum conditions in biodiesel production from waste frying oil using hydrodynamic cavitation process. The Central composite design of experiment was carried out using the MINITAB 17, and the results were analyzed using response surface methodology. The optimum conditions for biodiesel production were obtained when using oil to methanol molar ratio of 1:6, 1.1 wt.% of potassium hydroxide, inlet pressure at 3.27 bar with a reaction time of 8 min in hydrodynamic cavitation process. The highest yield (%) in the experiment and the model was 95.6±0.8% and 97.56% respectively. The biodiesel production was confirmed, by studying the GC-MS and FTIR spectra. Fuel characteristics were tested according to ASTM D6751 standard.

Keywords: Biodiesel, response surface methodology, central composite design, optimization, Hydrodynamic cavitation.

1- Introduction

The energy needs of the world are currently derived from petroleum, coal and natural gas. The world is presently confronted with the two main crises of reducing fossil fuel resources and environmental pollution. Therefore, there is an increasing worldwide concern for environmental protection and expansion of fuel resources [1,2]. Biodiesel is a mixture of alkyl esters of fatty acids [3]. Biodiesel produced via transesterification process (Fig. 1) which has proven to be a clean, economic