

Microwave-assisted biodiesel production by esterification of palm fatty acid distillate

ABSTRACT

In the current research work, effect of microwave irradiation energy on the esterification of palm fatty acid distillate (PFAD) to produce PFAD methyl ester / biodiesel was intensively appraised. The PFAD is a by-product from refinery of crude palm oil consisting >85% of free fatty acid (FFA). The esterification reaction process with acid catalyst is needed to convert the FFA into fatty acid methyl ester or known as biodiesel. In this work, fabricated microwave-pulse width modulation (MPWM) reactor with controlled temperature was designed to be capable to increase the PFAD biodiesel production rate. The classical optimization technique was used in order to study the relationship and the optimum condition of variables involved. Consequently, by using MPWM reactor, mixture of methanol-to-PFAD molar ratio of 9:1, 1 wt.% of sulfuric acid catalyst, at 55°C reaction temperature within 15 min reaction time gave 99.5% of FFA conversion. The quality assessment and properties of the product were analyzed according to the American Society for Testing and Materials (ASTM), European (EN) standard methods and all results were in agreement with the standard requirements. It revealed that the use of fabricated MPWM with controlled temperature was significantly affecting the rate of esterification reaction and also increased the production yield of PFAD methyl ester.

Keyword: Microwave irradiation; Esterification; Palm fatty acid distillate; Biodiesel; Homogeneous catalyst