Topic: Comparison of Kenics and SMX static mixers for use in biodiesel production with circulation system

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ABSTRACT

Static mixers are interesting devices for using in mixing applications and heat transfer capabilities, including biodiesel production. Static mixers have various designs for any proper purposes, but suitable models for biodiesel production process have not much been reported. In this study, standard types of static mixers, Kenics (a series of elements with short helixes of length equal to 3 times compared with the pipe radius and a twist angle of 180^{o}) and SMX (a complex series of cross-bars mixing elements) mixers, were used to produce biodiesel from coconut fatty acid via acid catalyst esterification in pilot-scale process using circulation system. Biodiesel production reactor with circulation system consisted of fatty acid tank, methanol tank, mixing tank, biodiesel tank, pump, and electric heaters, was employed to produce biodiesel. With 6:1 coconut fatty acid to methanol molar ratio, catalyst concentration of 0.7% v/v sulfuric acid (H_2SO_4) compared with fatty acid, and reaction temperature of 60 ^{o}C, SMX mixer can reached the highest fatty acid (FFA) conversion (88.40%), while Kenics mixer can achieve FFA conversion of 85.08%. Both types of static mixers can achieve FFA conversions more than referent cases, *i.e.* plain pipe and mechanical stirring (FFA conversions of 75.18 and 72.23%, respectively). In summary, the SMX mixer can be introduced as the most proper type static mixer for biodiesel production process (compared with Kenics mixer, plain pipe, and mechanical stirring), which it can provide FFA conversion and FAME yield more than 90% within 10 min of reaction.

Keywords: Coconut fatty acid, Esterification, Biodiesel, Static mixer, SMX, Kenics