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Transesterification of rapeseed oil by butanol and separation of butyl ester

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ABSTRACT

The paper describes the reactions and separations conditions for the transesterification of rapeseed oil by butanol under potassium hydroxide as a catalyst. The product is a mixture of butyl esters of higher fatty acids, which can be used as fuel (biodiesel) for combustion engines. The effect of the chosen reaction conditions (independent variables: the reaction temperature and time, the amount of catalyst, the molar ratio of butanol to oil and the method of oil addition to butanol) on the butanolysis process was studied. The measured data was analysed by multi-linear regression and the statistical models describe the dependency of glycerides (dependent variables) on the independent variables. The transesterification was stopped by neutralization of the catalyst with both a strong and weak acid been added to whole reaction mixture. The advantage of strong acid is a very fast separation and a zero content of potassium and free glycerol, nevertheless a high acid number (1.7 - 4.5 mg kg⁻¹). In the case of weak acid (gas carbon dioxide), the acid number is less than 0.5 mg kg⁻¹, but the separation takes longer. Moreover, the separation was sped up by the addition of a small amount of water to the reaction mixture after the reaction and removal of butanol. This way also decreased the content of potassium (10 times) and free glycerol (4 times) in the ester phase compare to the separation without water. Moreover, the relationship between the flashpoint and the content of butanol in butyl ester was described, which enables the determination only the butanol content and the calculation of the flashpoint or vice-versa.

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