BOX-BEHNKEN DESIGN FOR OPTIMIZATION OF MICROWAVE-ASSISTED TRANSESTERIFICATION IN THE PRODUCTION OF METHYL ESTER FROM COCONUT OIL USING CaO HETEROGENEOUS CATALYST

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ABSTRACT. The use of heterogeneous catalysts in the reaction transesterification for the production of methyl esters (biodiesel) usually requires high temperatures and under pressure conditions, whereas in temperature and atmospheric conditions, the yield of methyl esters is relatively low. By using microwave irradiation reactions with heterogeneous catalysts, it is expected that it will be faster and can produce higher yields. Therefore, we studied the production of methyl esters from coconut oil using microwave aid using a heterogeneous CaO catalyst. The purpose of this study was to obtain optimal conditions for the production of methyl esters from coconut oil through microwave-assisted transesterification reactions using heterogeneous CaO catalysts. The experimental equipment consisted of flat-bottomed flasks made of pyrex glass as a batch reactor placed in a microwave oven equipped with a stirrer, condenser and temperature controller. The batch process is carried out at atmospheric pressure with variations in microwave power, catalyst concentration and reaction time. The optimal conditions for microwave-assisted Transesterification Reactions are determined by surface methodology with Box-Behnken Design (BBD). Operating variables are microwave power (A: 100-400 W), CaO catalyst concentration (B: 1-2%) and extraction time (C: 1-2 minutes). In general, the production process of methyl esters by heterogeneous catalyst will obtain three layers, wherein the first layer is the product of methyl ester, the second layer is glycerol and the third layer is the catalyst. The experimental results show that the yield of methyl ester increases along with the increase of microwave power, catalyst concentration and reaction time. Correlation analysis of mathematical regression models shows that the squared polynomial model can be used to optimize microwave-assisted Transesterification Reactions.

Keywords: Box-Benhken Design, Methyl ester, Coconut oil, Microwave-assisted Transesterification, CaO catalyst