Chanatip Samart 2006: Copyrolysis of Plastic Waste and Cattle Manure to Fuel Oil. Doctor of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering.
Thesis Advisor: Associate Professor Apinya Duangchan, Ph.D. 172 pages.
ISBN 974-16-2840-4

Hydrogen chloride from pyrolysis of PVC can be reduced by copyrolysis with cattle manure. This research consists of three parts. First, statistical method was used to screen the experimental factors and find the optimum conditions. The reaction time was screened by 2^k factorial design. It was 60 min which provided the best result. The other factors: reaction temperature, heating rate and the ratio of PVC to cattle manure were optimized by Box-Behnken model. This design showed the best conditions for HCl reduction at low heating rate of 1°C/min, high reaction temperature of 450°C and cattle manure:PVC of 5:1. The model gave R^2=92.2% reliability and lack of fit was in the range of 90-95% reliability. The optimum conditions were applied to copyrolysis of cattle manure and PVC-containing plastic mixture. Cattle manure increased cracking activity, and the chlorine released from PVC in the plastic mixture was decreased by 45%. Copyrolyzed oil had good quality, high octane number (>95), and environmental friendly due to low aromatic compounds in the oil.

Second, kinetic parameters of Arrhenius equation of copyrolysis reaction of PVC and cattle manure were investigated by isothermal and dynamic methods. Both methods gave different reaction orders but showed similar tendency of reaction order. The results show that the reaction rates of dechlorination and decomposition were reduced by cattle manure because reaction order and pre-exponential factor decreased with increasing amount of cattle manure. Third, the copyrolyzed oils were upgraded by silica alumina, iron oxide-silica alumina, and zinc oxide-silica alumina catalysts. Silica alumina: ZnO composite catalyst at the ratio of 1:1, reaction temperature of 430°C, and feed rate of 30 ml/h were the optimum conditions for the lowest chlorine content in oil, high iso-paraffin, and high octane number.

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