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"Gheorghe Asachi" Technical University of Iasi, Romania

KINETICS OF WHEAT STRAW LIGNIN REMOVAL WITH OZONE

K. S. Baig*, J. Wu, G. Turcotte, H.D. Doan

Department of Chemical Engineering, Ryerson University, Toronto, Ontario M5B 2K3, Canada

Abstract

The delignification of wheat straw by ozonolysis was studied at room temperature and pressure. This physicochemical study aimed to contribute to the understanding of transport of ozone and delignification mechanism of wheat straw by reaction with ozone. The reaction proceeded by a gradual reduction of the lignin content from wheat straw until the maximum acid insoluble lignin (AIL) removed was reached to 90.45 % of the original lignin contents. Ozonation beyond the maximum delignification point was responsible for the lignin condensation.

The experimental kinetic data was not fitted to Mbachu and Manley model for the first order of reaction between ozone and wheat straw. Iribarne and Schroeder model was modified and it was observed that delignification of wheat straw obeys a pseudo-second order kinetic model trend. For the transport studies the Elovich model, Weber and Morris model were validated and it was observed that the experimental data was in a varying degree of agreement to these models. At higher supply flow rate of ozone, i.e. 4 L/min, surface reaction and intra particular diffusion contribute equally to the delignification reactions. At lower flow rate of ozone supply, i.e. 1 L/min, ozone reactions with wheat straw lignin follow the mechanism of intra particular diffusion reaction for delignification.

Key words: ozonation, biofuel, delignification, wheat straw, pore diffusion, pseudo second order

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* Author to whom all correspondence should be addressed: e-mail: k2shahza@ryerson.ca