Environmental Engineering Program

Is pleased to announce

The oral defense of the dissertation

Of

Luisa Cyd Charisse B. Biel

Entitled

HIGH SHEAR OXIDATIVE DESULFURIZATION OF FUEL USING QUARTERNARY PHOSPHONIUM SALT AND CHITOSAN IMMOBILIZED ONTO BENTONITE AS BIOADSORBENT

For the degree of

Doctor of Philosophy in Environmental Engineering

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Time: 9 AM to 12 NN

Adviser: Dr. Rizalinda L. de Leon
Co-adviser: Dr. Ming-Chun Lu
Co-adviser: Dr. Susan D. Arco
Co-adviser: Dr. Meng-Wei Wan

Panel Chairman: Dr. Maria Lourdes P. Dalida

Abstract

Elevated concentration of sulfur in diesel fuel is one of the major contributors to air pollution. To limit the amount of sulfur in fuel to less than 15 ppm, oxidative desulfurization was first studied using model diesel fuel using high shear mixer over two types of phase transfer catalysis (PTC) catalysts namely ammonium and phosphonium salt. The influence of several reaction variables such as the concentration of hydrogen peroxide, PTC catalyst, and co-catalyst on the conversion of the sulfur compound was also studied to optimize the system using response surface methodology. Treatment of model diesel fuel demonstrated 98% conversion to polar sulfones at 70 °C in less than 30 minutes of treatment. Based from the results, the reaction was chemically controlled pseudo-first order and the activation energy was 60 kJ/mol. After the oxidation process, the removal of polar sulfones from fuel using chitosan immobilized onto bentonite (CIB) was investigated in a fixed-bed column system. Maximum bed adsorption capacities for the various flow rates were found to be 4.30, 3.09, and 2.44 mg DBTO/g CIB at 1, 5, and 10 ml/min, respectively. Finally, using the optimized system actual diesel fuel was employed. The result showed 99.9% removal efficiency was demonstrated by the system followed by solid adsorption. Thus, the results obtained in this study clearly demonstrate the effectiveness of utilizing high shear oxidative desulfurization in achieving ultra low sulfur in fuel.

KEYWORDS: Oxidative desulfurization, Phase transfer catalysis, Chitosan immobilized onto bentonite