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# Ultrasound-assisted oxidative desulfurization (UAOD) using phosphotungstic acid: effect of process parameters on sulfur removal

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**ABSTRACT**

The oxidation of dibenzothiophene (DBT) and benzothiophene (BT) from a model diesel fuel, using hydrogen peroxide ($H_2O_2$) as an oxidant, was carried out in the presence of phosphotungstic acid and phase transfer agent (PTA) at 50–80°C. The desulfurization efficiency and selectivity for the various compounds were examined and compared on the basis of the amount of sulfur converted to polar sulfone. The effect of process parameters (temperature, amount of catalyst, amount of PTA, and $H_2O_2$ concentration) were investigated to determine the highest reaction rate on the conversion of BT and DBT. The results indicate that using $[PW_{12}O_{40}]^{3-}$ as a catalyst accelerates the reaction rate on the conversion of BT and DBT to their corresponding polar sulfones. High conversion (>99%) was achieved as the temperature was increased from 50 to 80°C. The activity of BT also increased markedly when the amount of oxidant increased. For DBT, as low as 0.02 M of $H_2O_2$ was enough to lower the concentration from 500 to 10 ppm at 80°C. The Arrhenius equation was appropriately applied to describe the data by using the pseudo-first-order reaction kinetic equation. The apparent activation energies for BT and DBT were determined to be 60.52 and 45.01 kJ/mol, respectively.

*Keywords:* Phase transfer agent; Phosphotungstic acid; Ultrasound-assisted oxidative desulfurization

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