200g A Novel Process for Deep Desulfurization of Dibenzothiophene under Mild Conditions

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Deep desulfurization of dibenzothiophene (DBT) with high selectivity was carried out with hydrogen peroxide as the oxidant at 50°C under atmospheric pressure. Octadecyltrimethyl ammonium bromide (STAB) and phosphotungstic acid were used as phase transfer catalyst and oxidation catalyst, respectively. The influence of reaction temperature, catalyst concentration and H2O2/DBT ratio on the oxidation of DBT was examined in details. A rise in the reaction temperature from 30 to 50oC led to a remarkable increase in the reaction rate. The STAB concentration played a crucial role in DBT oxidation and the highest reaction rate was obtained when the molar ratio between STAB and phosphotungstic acid approached 1 while superfluous STAB beyond this ratio brought about resistance for mass transfer of products and reagents at the interface. Reaction rate of DBT was improved upon increasing the H2O2/DBT ratio. Complete S-removal from a 3000ppm dibenzothiophene mixture was obtained within 15 minutes of reaction at 50oC under a H2O2/DBT molar ratio of 16. This oxidation process showed high selectivity towards DBT and experiments showed that desulfurization of DBT was accelerated when investigated in the presence of 2-methylnaphthalene. Kinetics of the reaction shows a pseudo-first-order toward DBT and the apparent activation energy Ea is determined to be 83.0kJ/mol.

Key words: desulfurization, oxidation, dibenzothiophene, selectivity, kinetics