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A novel method for ultra-deep desulfurization of liquid fuels at room temperature

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Abstract

A biomimetic catalytic system composed of iron hexadecachlorophthalocyanine ($FePcCl_{16}$), hydrogen peroxide (H_2O_2), H_2O and pyridine exhibited high activity for ultra-deep removal of dibenzothiophene (DBT) in model oil containing n-octane. The conversion of DBT was up to 100% after 60 min operation at room temperature. In addition, the $FePcCl_{16}$ catalyst could be recycled for more than 23 times without noticeable decrease on the conversion of DBT. Moreover, the activation energy evaluated through Arrhenius' equation was found to be equal to 25.5 KJ/mol. Nitrogen-containing compounds such as pyridine, quinoline, and acridine, naturally existing in many kinds of fuel oil, had previously been considered to inhibit the oxidative desulfurization (ODS) process. Surprisingly, these organonitrogen compounds could actually accelerate the conversion rate of DBT in this catalytic system. Mechanistic studies revealed that the high-valent iron(IV)-oxo species were