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Heterogeneous activation of peroxymonosulfate over monodispersed Co_3O_4 /activated carbon for efficient degradation of gaseous toluene

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Abstract: Gas-phase VOCs decomposition generally produces intermediates and causes secondary air pollution. To avoid this issue, we proposed a novel method for a typical gaseous VOC (toluene) degradation via catalytic activation of peroxymonosulfate (PMS) in the liquid phase. Herein, activated carbon supported monodispersed Co_3O_4 nanoparticles ($\text{Co}_3\text{O}_4/\text{AC}$) were prepared via a facile deposition method. It is highly efficient in PMS activation for toluene degradation due to the presence of Co-OH^+ species and well dispersed Co_3O_4 on $\text{Co}_3\text{O}_4/\text{AC}$. A toluene removal efficiency of nearly 90% was maintained during the reaction, and few gaseous intermediates were discharged. Sulfate radical ($\text{SO}_4^{\bullet-}$) and hydroxyl radical ($\text{HO}^{\bullet}$) derived from PMS activation played different roles during toluene oxidation and mineralization. Electron spin resonance (EPR) suggested that the generation of plentiful $\text{SO}_4^{\bullet-}$ resulted in the superior toluene degradation, and the presence of $\text{HO}^{\bullet}$ can improve carbon mineralization. Radical quenching tests further confirmed that $\text{SO}_4^{\bullet-}$ played a dominant role for toluene degradation, whereas the absence of $\text{HO}^{\bullet}$ inhibited the carbon mineralization. The toluene degradation pathway in the

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