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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 (Co_3O_4/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 Co_3O_4/AC. A toluene removal efficiency of nearly 90% was maintained during the reaction, and few gaseous intermediates were discharged. Sulfate radical ($SO_4^{\bullet-}$) and hydroxyl radical ($HO^{\bullet}$) derived from PMS activation played different roles during toluene oxidation and mineralization. Electron spin resonance (EPR) suggested that the generation of plentiful $SO_4^{\bullet-}$resulted in the superior toluene degradation, and the presence of $HO^{\bullet}$ can improve carbon mineralization. Radical quenching tests further confirmed that $SO_4^{\bullet-}$ played a dominant role for toluene degradation, whereas the absence of $HO^{\bullet}$ inhibited the carbon mineralization. The toluene degradation pathway in the