Oxidation of Bisphenol A by Activated Persulfate Using Iron(II) Entrapped Chitosan/Alginate Substrate

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Background/Objectives. The oxidative property of persulfate (PS) has been used to effectively treat a wide range of environmental contaminants. Using Fe(II) as an activator of PS is a viable option as a cost-effective and eco-friendly method. However, the use of Fe(II) as a homogeneous catalyst has a considerable drawback of scavenging the radicals and lowering the removal efficiency of target chemicals and their products. In addition, the removal of accumulated sludge containing Fe ions at the end of wastewater treatment is a costly process. Therefore, a novel Fe(II) releasing chitosan/alginate composite (Fe-Chitoal) was synthesized for the activation of PS to degrade bisphenol A (BPA).

Approach/Activities. The Fe-Chitoal was prepared by the simple cross-linking reaction between chitosan and alginate and Fe(II) was imprinted through chelating reaction with various functional groups in composite. The prepared Fe-Chitoal was characterized by SEM, EDX, FT-IR and XPS and the released amount of Fe was analyzed by ICP-OES. The BPA concentration and degradation byproducts were measured by HPLC and LC/MS. Effects of different experimental conditions like PS and Fe-Chitoal dosages, pH and anions (Cl^-, SO_4^{2-}, NO_3^-, HCO_3^-) on the removal of BPA were also investigated.

Results/Lessons Learned. The results indicated that the Fe was imprinted successfully into the composite. The Fe(II) (0.35 mM) was released from Fe-Chitoal (1g/L) without PS and Fe(III) was re-adsorbed after reaction with PS. Higher removal efficiency for BPA was obtained with PS/Fe-Chitoal than using homogeneous Fe(II) with PS. The removal increased as the PS and Fe-Chitoal dosage increased and high efficiency was maintained in the pH range of 2-10 and decreased dramatically at pH 12. The removal efficiency was also maintained at 100 mM of high anion concentration. Following the use of radical scavengers, an assessment of the BPA transformation products shows that the oxidation of BPA occurred by radicals at neutral pH. The main mechanism of PS/Fe-Chitoal was producing radicals such as ·OH and $SO_4^{\bullet-}$.