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Effective heterogeneous electro-Fenton process for the degradation of a malodorous compound, Indole using iron loaded alginate beads as a reusable catalyst

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Highlights

 Fe-ABs were fabricated by simple gelation procedure at 25 °C. ► The incorporation of iron on beads was confirmed by EDS results. ► The Fe-ABs catalyst present good stability and can be used for at least four times without obvious decrease in activity. ► Mineralization pathways of indole was proposed.

Graphical abstract

Abstract

In this work the characterization and the performance of iron immobilized in alginate beads (Fe-ABs) as catalyst for heterogeneous electro-Fenton (EF) treatment of a malodorous compound, indole, was investigated. Experimental results demonstrated that indole was effectively removed through the electro-Fenton process; while in the considered experimental conditions, the performances of EF were only slightly improved by the addition of UVA radiation.

The most efficient operating conditions were achieved at pH 3.0 in the presence of 200 mg.L^{-1} Fe-ABs catalyst (corresponding to an average iron concentration of 64 mg L^{-1}) with a current density of 0.53 mA cm^{-2}. Under these conditions, 60 min were sufficient to completely degrade 20 mg L^{-1} of indole, whose removal was found to obey the pseudo-first order model. In terms of organic carbon removal, about 90% mineralization yield was reached in the optimal conditions for 7 h heterogeneous electro-Fenton treatment time.

UPLC–MS/MS analysis was applied to identify and follow the evolution of indole oxidation products. Five stable organics intermediates were observed and four of them were identified as dioxindole, isatin, oxindole and anthranilic acid. A reaction sequence was therefore