Oxidation of amitriptyline and nortriptyline by ferrate(VI): efficiency and reaction pathways

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ABSTRACT

The oxidation of amitriptyline (AMI) and nortriptyline (NOR), two typical tricyclic antidepressants, has been studied in ferrate(VI) (Fe(VI)) solution. The removal rate of AMI and NOR increased with increasing Fe(VI) dosage and was seen to be pH dependent in the order pH 7.0 < 10.0 < 8.0 < 9.0. UV irradiation at 254 nm was found to exert a synergistic effect on the Fe(VI) oxidation of AMI and NOR. By LC–ESI-MS/MS analysis, the main oxidation products of AMI and NOR by Fe(VI) have been identified. The exocyclic double bond is first oxidized to give the exo-epoxide, which is then hydrolyzed and finally oxidized to give dibenzosuberenone and 3-dimethylamino-propionaldehyde. The results suggest that Fe(VI) has a good ability to oxidize AMI and NOR in aqueous solution and could be an effective treatment method for the purification of waters containing these particular antidepressants.

Keywords: Ferrate(VI); Tricyclic antidepressants; Oxidation; Products; Water treatment