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Experimental study on the abatement of ammonia and organic carbon with ozone

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ABSTRACT

Ammonia and organic carbon are commonly widespread substances both in municipal and in industrial wastewaters and are usually treated having recourse to biological processes. This work presents some preliminary results useful for the design of an oxidation treatment using ozone which has effect on both ammonia and organic carbon. In the first part of the paper the oxidation of relatively low concentrations of ammonia (20 mg/l) by means of ozone and halides (chloride, bromide) was investigated with the aid of on-purpose made solutions. The experimental findings pointed out that the reaction rate of an oxidation process involving ammonia and ozone (or ozone and halides) is different from a zero-order kinetics and is affected by the presence of free OH^- ions. In fact high pH values promote both the ozone (O_3) decomposition in $HO^\bullet$ radicals and the displacement of the ammonia equilibrium (NH_3/NH_4^+) toward NH_3. Chloride was found to have no effect on the ammonia oxidation, on the other hand, the joined effect of ozone and bromide results in a more effective and faster reaction, which generates lower amounts of nitrate in comparison with the oxidation due to the only ozone and/or $HO^\bullet$ radicals. In the second part of the work the oxidation of organic carbon (as potassium hydrogen phthalate) with ozone or bromide/ozone was investigated. In the process of the ozonation of organic carbon, bromide has no effect on the reaction rate, but it seems to slow down the process because of the competition between the oxidation of the potassium hydrogen phthalate and the formation of HOBr. The obtained results show that the oxidation stops when the residual concentration of organic carbon reaches a value equal to about 50% of the initial value.

Keywords: Ozone; Ammonia; Organic carbon; pH; Chemical equilibrium; Wastewater

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