The Study on the Mass Transfer and Reaction Behaviors for the Treatment of Organic Wastewaters by Catalytic Ozonation

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ABSTRACT

ABSTRACT Mass transfer and self-decomposition behaviors of ozone molecular are the most important factors on the treatment efficiency of ozonation process for decomposing pollutants in aqueous solutions. The purpose of this study is to investigate the effects of catalytic types and amount on the mass transfer and self-decomposition behaviors of ozone molecular under various operational conditions. The catalysis used in this work were Al2O3, MnO2, SiO2, and PAC. The decoloration of Red 4 dye wastewater by ozonation with or without different catalysis was explored to examine the influence of various catalysis on the removal rate of Red 4. Experimental results showed that mass transfer rate of ozone can be slightly raised by the addition of catalysis, and the most significant one to lift the mass transfer rate was found to be PAC. The promoting effect of catalytic amount of each catalysis on the mass transfer rate of ozone was found to be negligible. However, the promoting effect of catalytic amount of Al2O3 and PAC on the self-decomposition rate of ozone was found to be relatively obvious. At lower pH levels, the promoting effect of adding MnO2 on the mass transfer rate of ozone is noteworthy compared to other catalysis while its value of KLa was determined to be 0.5488min-1. The self-decomposition rate constant (kd) of ozone increased with increasing pH and the value was determined to be 2.3141 min-1 at pH 9. In the system of the decomposition of Red 4 by ozonation, the promoting effect of adding PAC on the decoloration rate of Red 4 was found to be the largest one compared to other catalysis that those promoting effect was relatively trivial. The reaction rate of Red 4 by ozonation can be raised by adding catalysis at higher pH levels indicating that the indirect oxidation reaction of Red 4 by OH. which is generated by the reaction of ozone and hydroxide ions can be effectively elevated. Three possible reaction models were proposed to reasonably describe the reaction mechanisms of ozone and Red 4 on or off the surface of catalysis in aqueous solutions.

Keywords : ozone of mass transfer coefficient ; self-decomposition ; ozonation ; catalytic ozoantion

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