Study on the Decomposition of Dye Wastewaters by Ozonation Process in the presence of Modified Photocatalyst

Lai Yung-Chang, Shen Yong-Sun
E-mail: 9805415@mail.dyu.edu.tw

ABSTRACT

The purpose of this study is to utilize three kinds of Advanced Oxidation Processes, ozone, ozone/catalyst and ozone/photocatalyst, and treat wastewater containing acid dyes, such as Acid Orange 8, Acid Blue 29 and Acid Blue 113, in order to discuss the impact of operating factors in reaction system, such as initial pH of solution, catalyst level and dye type, on acid dye removal rate and reaction rate. This study also aimed to modify Degussa P-25 photocatalyst by adding various levels of silver nitrate (AgNO₃), and prepare metal catalyst by means of Incipient Wet Impregnation and Impregnation methods, coupled with Heat Reduction method and Photocatalytic Synthesis respectively. The results indicated that, preparing metal catalyst by means of Impregnation plus Photocatalytic Synthesis could deposit silver atoms over catalyst surface effectively. Ozone mass transfer and autodecomposition in liquid phase before and after modifying catalyst were studied. Ozone autodecomposition leads to the falling trend of saturation curve, and it also indicates higher oxidizing ability since it can produce strong oxidizing hydroxyl radicals (OH·). As a result, in case of modified catalyst with 5.0wt% Ag-TiO₂, solution pH at 3.0, and catalyst addition level at 3.0 g/L, ozone saturation curve drops most significantly. In case of ozone solution pH at 3.0, 5.0, 7.0, 9.0, when catalyst addition level is 1.0 g/L, this catalyst could be most effective to enable ozone autodecomposition. In running batch reaction of acid dye treatment through O₃/Catalyst process, adding metal catalyst can allow silver atoms deposited on catalyst surface to catalyze ozone reaction to generate hydroxyl radicals (OH·), and attack dye molecules adsorbed onto catalyst surface. Under reaction conditions such as solution pH of 3.0, 5.0wt% Ag-TiO₂ level of 1.0 g/L, initial concentration of Acid Orange 8 at 0.11mM, ozone level at 5 mg/L, Acid Orange 8 could obtain the optimum reaction rate. In running batch reaction of acid dye treatment through O₃/UV/Catalyst process, added metal catalyst could produce electrons and electron-hole pairs under UV excitation, silver atoms deposited onto catalyst surface could dissociate electrons from electron-hole pairs quickly. The electrons could react with ozone adsorbed onto catalyst surface to generate hydroxyl radicals (OH·), and attack dye molecules adsorbed onto catalyst surface. Under reaction conditions such as solution pH of 3.0, 5.0wt% Ag-TiO₂ level of 1.0 g/L, initial concentration of Acid Orange 8 at 0.11mM, ozone level at 5 mg/L, Acid Orange 8 could obtain the optimum reaction rate. This study compared three kinds of Advanced Oxidation Processes, and found that ozone plus photocatalyst process has the best reaction rate of removing acid dye, ozone/catalyst process followed, and pure ozone process is the worst.

Keywords: Advanced Oxidation Processes, Acid dye, Impregnation, Photocatalyst, Photocatalytic Synthesis, Ag/TiO₂
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5.3.4 綜合比較

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5.4.2 添加觸媒對臭氧自解之影響

5.4.2.1 添加 TiO₂對臭氧自解之影響

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6.1 結論

6.2 建議

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