



Heterogeneous catalytic ozonation of paper-making wastewater with $\alpha\text{-Fe}_2\text{O}_3/\gamma\text{-Al}_2\text{O}_3$ as a catalyst for increased TOC and color removals

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ABSTRACT

There exists great passion to develop an economical and high-efficient catalyst for the catalytic ozonation treatment of biologically recalcitrant wastewater. The present work utilized a $\text{Fe}/\gamma\text{-Al}_2\text{O}_3$ catalytic ozonation process for tertiary treatment of actual paper-making wastewater. Results indicated that in comparison with ozone alone, the addition of a $\text{Fe}/\gamma\text{-Al}_2\text{O}_3$ catalyst enhanced the removal efficiency of total organic carbon (TOC) during ozonation after 60 min of treatment, which initiated a 25% enhancement for TOC removal. After 60 min of treatment, TOC removal rates reached 51% using $\text{Fe}/\gamma\text{-Al}_2\text{O}_3$ as a catalyst, 37% in the presence of $\gamma\text{-Al}_2\text{O}_3$ and only 26% with ozonation alone, which already showed excellent color removal results. The presence of *tert*-butanol (a well-known hydroxyl radical scavenger) had a negative effect on the TOC removal rate of the $\text{Fe}/\gamma\text{-Al}_2\text{O}_3/\text{O}_3$ process, indicating that the $\text{Fe}/\gamma\text{-Al}_2\text{O}_3/\text{O}_3$ process follows a hydroxyl radical ($\cdot\text{OH}$) reaction mechanism. Finally, the prepared $\text{Fe}/\gamma\text{-Al}_2\text{O}_3$ catalyst exhibited good stability and recyclability. These results illustrate that there are potential applications of ozonation catalyzed by $\text{Fe}/\text{Al}_2\text{O}_3$ for the tertiary treatment of biologically recalcitrant wastewater.

Keywords: Catalytic ozonation; $\gamma\text{-Al}_2\text{O}_3$; $\alpha\text{-Fe}_2\text{O}_3$; Paper-making wastewater; TOC

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