



## Investigation of the synergistic effect of the Fenton process on the paint industry wastewater treatment and optimization of independent process parameters

Ömer Apaydin\*, Uğur Kurt, Fatih İlhan

*Yildiz Technical University, Faculty of Civil Engineering, Department of Environmental Engineering, Davutpaşa Campus, 34220 Esenler, Istanbul, Turkey, Tel.: +90 2123835387; email: apaydin@yildiz.edu.tr (Ö. Apaydin), Tel.: +90-212-3835392; email: ukurt@yildiz.edu.tr (U. Kurt), Tel.: +90-212-3835396; email: filhan@yildiz.edu.tr (F. İlhan)*

Received 26 April 2023; Accepted 28 August 2023

---

### ABSTRACT

Paint industry wastewater is hard to treat due to its complex and changing structure. In the study, the Fenton oxidation process was used to treat this wastewater. The pH levels required for the Fenton process were obtained without any chemical addition other than Fenton's catalyst and oxidant. Reaction time, H<sub>2</sub>O<sub>2</sub> concentration, and Fe<sup>2+</sup> concentration were chosen as independent parameters for the experimental design employing Taguchi orthogonal arrays. These independent parameters were varied at four different levels to find out their effects on the removal efficiencies of the dependent parameters. Chemical oxygen demand (COD) and color were chosen as the dependent parameters. The removal efficiencies of COD and color were obtained at 69% and 98%, respectively. According to optimization studies, the degree of effect of H<sub>2</sub>O<sub>2</sub> concentration, Fe<sup>2+</sup> concentration, and reaction time on COD removal performance were obtained as 12.01%, 23.87%, and 21.67%, respectively. Moreover, the degree of effect on color removal performance of H<sub>2</sub>O<sub>2</sub> concentration, Fe<sup>2+</sup> concentration, and reaction time were obtained as 15.08%, 19.00%, and 22.42%, respectively. Furthermore, the results from this experimental optimization study show that the synergistic effect of Fenton oxidation on COD removal provides additional removal efficiency reaching 190% compared with H<sub>2</sub>O<sub>2</sub>'s real oxidation potential.

*Keywords:* Fenton process; Optimization; Paint industry wastewater; Synergistic effect; Treatability

---

\* Corresponding author.