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TREATMENT OF A TEXTILE WASTEWATER USING SULFATE AND HYDROXYL RADICALS BASED OXIDATION UNDER THE UV LIGHT: A COMPARISON BETWEEN UV/H₂O₂, UV/PS AND UV/PMS

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Abstract

In this study, chemical oxygen demand (COD), total organic carbon (TOC) and color removal efficiencies and treatment costs were compared with three different oxidation processes using hydroxyl or sulfate radicals in a textile wastewater. UV/H₂O₂ process was used to obtain hydroxyl radicals, UV/PS and UV/PMS were used to obtain sulfate radicals. Optimum catalyst concentrations and optimum pH values were determined for all three processes by investigating COD, TOC and color removal efficiencies. According to the results, the highest removal efficiencies were obtained under the optimal conditions of pH: 7 in UV/PS oxidation, pH: 8 in UV/PMS oxidation, and pH 4 in UV/H₂O₂ oxidation. The COD, TOC and color removal efficiencies were obtained as 85.5%, 65.7% and 99.0% in UV/PS oxidation (COD/PS: 1/5, pH: 7) and 81.8%, 70.3% and 96.7% in UV/H₂O₂ oxidation (H₂O₂: 1750 mg/L, pH: 4), respectively. The COD, TOC and color removal efficiencies were 65.9%, 37.3% and 98.8% in UV/PMS oxidation (COD/PMS: 1/10, pH 8), respectively. UV/PMS oxidation was sufficient in terms of color removal, but not satisfactory in terms of organic matter removal. The order of performance of the processes was as follows: UV/PS>UV/H₂O₂>UV/PMS. The ranking according to total cost was as follows: UV/PS<UV/H₂O₂<UV/PMS. In UV/PS, UV/PMS and UV/H₂O₂ processes, electricity costs were 23.9, 26.8 and 30.4 \$/kg COD_{removed}, while chemical usage costs were 4.33, 33.38 and 3.17 \$/kg COD_{removed}, respectively. According to the results of the study, high color removal efficiencies were achieved with all three oxidation processes in the treatment of this textile wastewater, while UV/PS oxidation showed higher treatment performance and lower cost than UV/H₂O₂ and UV/PMS.

Keywords: advanced oxidation processes, cost, hydroxyl radical based oxidation, textile wastewater

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