**Treatment of industrial wastewater by hybrid technique of adsorption (Fe3O4@AC nanocomposite) + heterogeneous Fenton + sonication and discernment of synergistic effects**

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**Abstract**

This paper reports investigations in mineralization of industrial wastewater (COD = 3246 mg/L, TOC = 2500 mg/L) using ternary (ultrasound + Fenton + adsorption) hybrid advanced oxidation process. Fe3O4 decorated activated charcoal (Fe3O4@AC) nanocomposites (surface area = 538.88 m2/g; adsorption capacity = 294.15 mg/g) were synthesized using co-precipitation. The wastewater treatment process was optimized using central composite statistical design. At optimum conditions of pH = 4.2, H2O2 loading = 2.5 mL, adsorbent dose = 50 mg, reduction in COD of wastewater were 94.75%, respectively. These results are attributed to synergistic interactions between adsorption of pollutants on Fe3O4@AC, surface Fenton reactions and enhanced mass transfer due to sonication. This synergism boosted the interactions among  radicals and pollutant molecules leading to effective degradation and mineralization. The Fe3O4@AC showed excellent recovery (> 90 wt%) and reusability (> 90% COD removal) in 5 successive cycles of treatment.