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The inactivation of fecal coliform using Fe_3O_4@Cu nanocomposite in real wastewater: emphasizing on synergic effect and inactivation mechanisms

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ABSTRACT

Fecal coliforms (FCs) are the main bacteriological indicators in the wastewater reuse. This study was conducted to evaluate the antimicrobial activity of Fe_3O_4@Cu nanocomposite for the FCs inactivation and to describe the inactivation mechanisms in real wastewater. Operational factors affecting the disinfectant process including pH, contact time, reagent dosage, wastewater quality, and synergic effect were studied. Results indicated iron has no synergic effect on antibacterial activity of copper but it can improve the toxicity of Cu. The inactivation of FCs until 40 min was corresponded to Cu^{+} and Fe^{+2} ions. Increasing of total suspended solids (7–20 mg/L) and organic matter (13–24 mg/L) cause decreasing of antibacterial activity of Fe_3O_4@Cu up to 0.384 log, therefore, the inactivation of FCs in raw wastewater (RW) was less than activated sludge effluent (ASE). Increasing of reagent dosage up to 15 mg/L increased the FCs inactivation to 0.053 and 2.13 log for RW and ASE, respectively. The FCs inactivation was raised in acidic condition compared with natural and alkali conditions and specific lethality (Λ_{CW}) for Fe_3O_4@Cu nanocomposite was obtained 3.4 and 212 times more than those of Cu and Fe_3O_4. It can be concluded that the Fe_3O_4@Cu nanocomposite is effective antibacterial agent especially for ASE that can achieve WHO guideline and Iranian national standard limits.

Keywords: Fe_3O_4@Cu; Disinfection; Fecal coliform; Wastewater; Synergic effect

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