Influence of pH on photocatalytic reduction, adsorption, and deposition of metal ions: speciation modeling

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ABSTRACT

The present study is targeted on photocatalytic removal of metal ions from wastewater. Photoreduction, deposition, and dark adsorption of Cr$^{6+}$, Cu$^{2+}$, Ni$^{2+}$, and Zn$^{2+}$ metal ions have been investigated using TiO$_2$ with UV-irradiated. Also investigated that citric acid as a hole scavenger and hydrogen peroxide as an oxidant at pH values 2, 4, 6–8, and 10. The modeling of metal species has been performed and speciation is used as a tool for discussing the photoreduction and deposition trends. The modeling of metal species at different pH values has been performed. It was observed that the photocatalytic process was effective in removing most of the metal ions in specific reaction circumstances. The maximum reduction and deposition of Cr and Cu$^{2+}$ were found to be favorable at acidic pH 2–4, while Ni$^{2+}$ and Zn$^{2+}$ reductions were found to be most suitable at neutral to alkaline pH 10. The photocatalytic reduction and deposition trend of the metal ions prove the theoretical thermodynamic predictions about a reaction time period (5 h).

Keyword: Photocatalysis; Citric acid; Hydrogen peroxide; Metal ions; PH; Modeling; Speciation; Adsorption; Reduction; Deposition

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