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Utilization of solar energy for photoreduction of industrial wastewater containing hexavalent chromium with zinc oxide semiconductor catalyst

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ABSTRACT

Scarcities of water and energy are going to be critical in the near future. A possible remedy is to reuse industrial wastewater after suitable treatment using a renewable energy. In this work, wastewater containing hexavalent chromium is treated with Zinc oxide (ZnO) semiconductor photocatalyst in the presence of sunlight to reduce the more toxic hexavalent metal to its less toxic trivalent counterpart. Thirty five percent reduction was obtained after 2 h with 10 mg/L substrate, 0.4 g/L photocatalyst, and 75kLux solar radiation at 31°C temperature. Process parameters are initial concentration of substrate, loading of photocatalyst, pH and concentration of the electron donor. Initial rate of reduction varied only with ZnO-loading and hence it was zero order with respect to both the substrate and electron donor. An alternative rate equation based on the modified Langmuir Hinshelwood Hougen Watson (LHHW) model compares well with the mechanistic rate equation.

Keywords: Hexavalent chromium; Solar energy; Photoreduction; ZnO-semiconductor

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