Photocatalytic removal of *Escherichia coli* from aquatic solutions using synthesized ZnO nanoparticles: a kinetic study

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ABSTRACT

Development of effective and low-cost disinfection technology is needed to address the problems caused by an outbreak of harmful microorganisms. In this work, an effective photocatalytic removal of Gram-negative bacteria *Escherichia coli* from aqueous solution was reported by using ZnO nanoparticles under UV light irradiation. The effect of various parameters such as solution pH, ZnO dosage, contact time and initial *E. coli* concentration were investigated. Maximum photocatalytic disinfection was observed at neutral pH because of the reduced photocatalytic activity of ZnO at low and high pH values originated from either acidic/photochemical corrosion of the catalyst and/or surface passivation with $Zn(OH)_2$. As the ZnO dosage increased, the photocatalytic disappearance of *E. coli* was continuously enhanced, but was gradually decreased above 2 g/L of ZnO due to the increased blockage of the incident UV light used. The optimum ZnO dosage was determined as 1 g/L. Photocatalytic removal of *E. coli* decreased as initial *E. coli* concentration increased. Three kinetic models (zero-, first- and second-order equations) were used to correlate the experimental data and to determine the kinetic parameters.

Key words | disinfection, *Escherichia coli*, photocatalysis, synthesis, ZnO

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INTRODUCTION

Rapid industrialization and urbanization cause contamination of a lot of water resources by discharging wastewater containing organics, microorganisms and metallic elements (Christensen *et al.* 2003). Wastewaters usually contain high levels of microorganisms. Therefore disinfection is an important and essential aspect of

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