

Sensitizing Zinc Oxide Photocatalyst with Natural dye for Water Disinfection under Sun Light

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Abstract

Several procedures are commonly used for water disinfection from bacteria. Examples are chlorination, peroxide addition, ozonation and UV irradiation. Photodegradation of microorganisms has also been examined. TiO₂ and ZnO were examined by researchers for inactivation of Escherichia coli and some other types of bacteria using photo-degradation techniques.

ZnO is a wide band gap (3.2 eV) semiconductor, with limited photo-catalytic applications to shorter wavelengths only, and demands UV region for excitation. However, it has attracted attention as an interesting alternative to TiO₂ in dye sensitized solar cells. ZnO has the advantage of being sensitive to solar UV light.

Because only about 4% of the solar spectrum falls in the UV region, ZnO semiconductor is sensitized by dye molecules. Sensitized ZnO catalysts have been investigated for organic pollutant degradation in a safe and simple manner.

In this work, ZnO semiconductor nano-particles, combined with safe low cost sensitizer (natural dye anthocyanin) was used to disinfect water from bacteria by photodegrading it with solar simulator light. The natural dye sensitized ZnO to the visible light, as the dye has smaller band gap and absorbs in the visible region.

Illumination has been constructed by a solar simulator lamp. A pre-contaminated water sample with E-Coli bacteria was treated with the catalyst (ZnO/anthocyanin) under halogen spot lamp. A noticeable decline in bacteria concentration was observed. Contaminated samples were treated with naked ZnO, anthocyanin dye, and light source (without any additions) separately in control experiments.

Up to 90% degradation was achieved by the ZnO/anthocyanin catalyst system under solar light in 90 minutes. Effect of different parameters on reaction rate and efficiency, such as temperature, pH, concentration and others were also studied and will be presented.

Key Words: ZnO, bacteria, photo-degradation, anthocyanin.