INVESTIGATIONS ON THE PHTOCATALYTIC DEGRADATION OF SULPHUR POLLUTANTS USING ZnO

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Abstract

It is a well-established fact that combustion of fossil fuel, especially under incomplete combustions, produce number of environmentally hazardous chemicals. Increased consumption of S-containing diesel fuel in transportation and energy production has contributed to the elevation of pollution levels in Colombo and its suburbs. The impact due to pollution is indicative from the medical statistics where respiratory problems have been among the top two reasons for the hospitalisation in Sri Lanka during last three decades.

To date, few investigations have focussed on controlling airborne pollutants to mitigate the environmental and health risks. Our attempt is to develop a photocatalytic system to degrade S-containing pollutants. Recent investigations have found that metal oxide based semiconductors, particularly ZnO and TiO_2 have characteristic properties to serve as photocatalysts in getting rid of pollutants in air and water media. In comparison with TiO_2, ZnO shows significantly higher photocatalytic activity for the degradation of thiourea. Use of a 300 ppm ZnO solution itself has contributed to a 50% degradation from 100 ppm thiourea solution after two hour irradiation. It was found that the degradation process follows first order kinetics. Further, ZnO treated at 200 ^{0}C-300 ^{0}C in air displayed high activity (70%) degradation and nickel doped ZnO displayed 60% degradation of thiourea after two hour irradiations.

Despite its few undesirable properties ZnO is a good photocatalyst owing to its large bandgap, higher excitation energy, thermal stability, optical transparency and piezoelectric properties. Results of this research indicate that ZnO degradates thiourea in aqueous phase to sulfate, nitrate, nitrite and hydrogen ions. Currently we are investigating ZnO's ability to degradate airborne S and N compounds.