Minor Research Project

Title of Project : **"*Environmental Remediation of Wastewater Containing Dyes with Nanophotocatalyst* "**

Subject : Chemistry

Project Duration : 2 years (2013-2015)

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SUMMARY OF FINDINGS

The present investigation entitled "***Environmental Remediation of Wastewater Containing Dyes with Nanophotocatalyst*** " has led to some important conclusions as stated below.

1. The solar photo catalytic oxidation using environmental friendly oxidant H_2O_2 and non toxic nano photo-catalysts ZnO and CuO proves itself to be a feasible and relatively inexpensive process. The oxidant hydrogen peroxide shows a rapid decrease in concentration on exposure to solar radiation and is completely utilized when used in optimum concentration levels in the reacting system.

2. The photo oxidative treatments are also environmental friendly since the contaminants are totally mineralized rather than transferred from one phase to another, thus avoiding the possibility of secondary pollution.

3. The AOPs offer an attractive feature that the substrate or pollutant can be completely eliminated. These advantages offered by hydrogen peroxide justified its choice as the environmental friendly oxidising agent.

4. The decay of oxidant H_2O_2 followed very closely the zero order kinetics. The optimum stoichiometric ratio of oxidant to COD concentration (H_2O_2: COD) was determined to be 1:1.2.

5. The advanced photo-oxidation processes are strongly pH dependent. The results show that the substrate degradation proceeded slowly in the initial one hour of reaction time followed by a faster pace and complete mineralization of the substrate within four hours of contact time.

6. The photo oxidation treatment offers an additional advantage as compared to other well known secondary and tertiary treatment processes, in that, it not only mineralizes the waste but also causes complete decolourisation, deodorization and disinfection of the wastewater.

7. The photo catalyst concentration plays an important role in the photo-oxidation process. The heterogeneous photo catalytic process using photo catalyst ZnO and CuO assisted by solar irradiation gave about 90-95 % pollutant degradation efficiency as compared to the homogenous photolytic oxidation by H_2O_2 assisted by solar irradiations.

8. Solar $+H_2O_2+$ nanophotocatalyst shows treatment efficiency greater than solar$+H_2O_2$ processes up to certain limit beyond that limit %degradation efficiency decreases. The

increase in the amount of catalyst increases the number of active sites on the catalyst surface that in turn increases the number of .OH and O_2^{-2} radicals. The reactor contents become turbid and opaque to light in presence of the very fine photo catalyst particles in suspension form, leading to decreased penetration of the solar irradiation as well scattering of the solar rays. This reduces the generation of electron-hole pairs and ultimately leads to decreased treatment efficiency.

9. Photo catalysis is a clean technology, which normally does not involve any waste disposal problem. The added photocatalyst can be recovered, recycled and reused after the treatment and can be used at least twice without significant change in the efficiency.

10. The heterogenous photo catalysis is a prominent method for degradation of dyes and contained industrial wastewater, in aqueous system under simple handling with no specific technical equipment is necessary and also in-expensive with less investment, less energy demand and produce harmless by products.

11. Although ZnO is the most efficient catalyst in the degradation of many organic pollutants & dyes but it has the disadvantages of undergoing photo corrosion under illumination in acidic conditions.

14. Future research must also investigate the effectiveness of these technologies in the combination with other cost effective treatments such as biological treatment.

15. Easy preparation, handling and separation of photocatalyst from solution are some advantages of this system. Improvement of photocatalytic activity of this system by doping of some metal on catalyst surface is under investigation in our library.

The present work thus justifies the aims and objectives as enumerated earlier.