

## PREFACE

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The word graphene oxide is oxide form of graphene connected to oxygen functional groups viz. carboxylic acid groups (-COOH), hydroxyl groups (-OH) and an epoxy group (-C-O-C) on both edges and hybridized surface of the basal plane through  $sp^3$  hybridization. It has attracted intense scientific interest due to its exceptional electrical, mechanical and chemical properties over the last couple of years. It has potential applications in advanced electronic devices and composite materials. There are different methods such as Staudenmaier's, Hummers, Modified Hummers and Tour's methods to produce graphene oxide. Among them modified hummer method is considerable to produce graphene oxide in large quantities with containing functional groups which makes graphene oxide (GO) sheets hydrophilic to form stable aqueous colloids.

Developing the graphene oxide based nanoceramic composites to select the metal oxide materials such as ZnO, which is excellent photocatalytic performance. Few commonly used morphology of nanoceramic is studied comparatively and in a combination with rGO to deduce an optimum content. These approaches were put into effect as counter measures against the problems caused to modify the surface area and reactivity.

The aim of this work was set to develop efficiently and practical new methods to incorporate or supported particular morphology of nanoceramic on reduced graphene oxide sheets. It can improve photocatalytic properties, recombination rate and photo degradation reaction of natural dye and phenolic compound under sun light irradiation.

In my work, I faced the problem from different sides, using many analytical techniques to study the changes occurring both in the material and in the formulation, although the main focus of the work was the analysis of changes in morphology of material. Nevertheless, this type of study is still quite limited; especially if compared with the years- long research carried out on the properties of rGO-ZnO composites. I hope that the following work may contribute to improve the reusability of these nanoceramic composites for degradation of organic pollutant.

The subject matter of the thesis is divided into the following eight chapters:

- **Chapter 1** is the introduction, and objective of the present research work, comprising of a general introduction of reduced graphene oxide nanoceramic composites.
- **Chapter 2** presents the fundamentals of present research work with detailed literature survey, starting from history of reduced graphene oxide to nanoceramic composites and its application.
- **Chapter 3** presents the materials, methods and their characterization technique which are used in present research work with detail
- **Chapter 4** is a research work related to the effect of synthesis temperature on reduced graphene oxide nanoceramic composites and Studies on their controlled lotus like structural, properties and photocatalytic application with phenol.
- **Chapter 5** discusses the effect of pH on reduced graphene oxide nanocomposites, Studies on their columnar structural, properties and photocatalytic performance with natural dye.
- **Chapter 6** is a research work related to the effect of high annealing temperature on ZnO hexagonal plate and has been included its optical and dielectric properties.
- **Chapter 7** combines the overall conclusive statements of all the works as mentioned chapter wise. It is finally followed by references and list of publications and their reprints.