Preface

Past several decades' attention of scientists and researchers has been focused on use of biological techniques for waste management and this new emerging area is commonly known as Environmental Biotechnology. Environmental Biotechnology is co-branch of biotechnology and its goal is to find the solution of the global environmental problems by developing biological processes which are cost-effective, eco-friendly and rapid in nature.

Benzene is a chemical compound released in the atmosphere as a result of various natural as well as manmade processes. It is found in gases released from volcanoes, forest fires, cigarette smoke, evaporation of gasoline and crude oil. It may be colorless or light yellow and it is extremely flammable. According to the Occupational Safety & Health Administration, its continuous exposure may cause cancer. Inhalation or absorption of benzene above permissible limit is harmful to human organs such as liver, kidney, lung, heart and brain, etc. The USEPA has set $5\mu gl^{-1}$ as maximum permissible limit of benzene in drinking water. As level of Benzene in the atmosphere as well as water resources are increasing day by day, there is a urgent need to pay attention to this problem and develop sustainable and ecofriendly treatment techniques for benzene. Biological treatment techniques have shown great potentiality to treat benzene and other organic contaminants present in liquid and gaseous phase in sustainable, cost effective and ecofriendly manner but slow nature and unreliability of these techniques still prohibit the industries and other users for application at commercial level. Researchers all over the world are working to overcome the limitations of biological techniques and make it suitable for industrial applications. Treatment of organic wastes

in different types of bioreactors has been demonstrated to be an efficient technology by the researchers. Researchers are working on improving the performance of bioreactors by using different types of bioreactors according to need, optimization of process parameters, suitable packing media in the bioreactors, isolation of efficient microorganisms and using enzymes instead of microorganism as biocatalyst in the bioreactors.

Bioreactor packing media may be categorized as natural, inert or synthetic packing materials. For the long-term operation of bioreactor, natural packing materials such as compost, agro waste, peat, soil etc are used. These natural materials cracks and causes medium compaction which results in the failure of the bioreactor system. Synthetic non-biodegradable media was used to overcome these problems. Inert materials like PUF, Alginate beads etc. are mechanically strong but usually require a periodical nutrient supply during the operation of any bioreactor and also these materials are cost effective.

Synthetic packing materials are of good option because they are mechanically strong and also there is no need to supply nutrients to the microorganisms because it is added in the packing media during the preparation of such packing materials. Physico-chemical properties of the modified (synthetic) materials such as porosity, surface area water retention capacity can also be improved after modification. One of the most challenging problems to use the bioreactor at industrial scale is continuous supply of nutrients during the course of operation. In present research work, two modified packing media was used namely PUF and alginate beads.

Chapter 1 Deals with Benzene application, bioremediation of benzene and types of biological processes **Chapter 2** include literature survey and **Chapter 3** includes materials and method of experimentation. **Chapter 4** illustrates results and discussion in details about benzene biodegradation in batch and continuous system **and Chapter 5,** states the conclusion.

At last section of thesis, References and Appendix have been cited.