PREFACE

The insistent human pursuits for improvement of living standards such as mining and extraction of minerals and oils have enhanced the environmental pollution several folds. However, the wastes generated from such industries are toxic and carcinogenic, having detrimental effect on the environment and human health. The apposite management of such waste is one of the most serious issues confronted by environmentalists currently. Several physical, chemical and biological methods have been approached to degrade these pollutants from the solid waste. Among these, biological degradation has been adapted as most propitious techniques for the degradation of these polyethylene pollutants.

Bioremediation looks very promising, sustainable and economically feasible technique for the management of polyethylene waste as it do not generates another type of waste, which is commonly produced in majority of the physical and chemical treatment techniques. It is cost-effective and brings complete mineralization of the even recalcitrant organic pollutants and generates non-toxic end-products. It has proved to be a huge success in the laboratory and also in many cases, in the natural environment. However, there have also been many failures in the field studies due to ill-responses of microbial communities under the field conditions. The need of the hour is to identify the novel microorganisms or consortium for efficient biodegradation process and the mechanisms to enhance their biodegradation potential.

The subject matter contained in the thesis has been arranged in seven different chapters including references.

Chapter 1 introduces the problem of various polyethylene wastes, its production and consumption rate at global as well as national level. Various methods used for the treatment of these pollutants.

Chapter 2 presents a critical review of the available literature on the degradation of polyethylene. Further, it also gives an idea about the emerging process (i.e. biodegradation). A comprehensive and critical assessment of the efficacy of various microbes used for the degradation processes is also discussed. This also provides a futuristic picture of the research required for the sustainable abatement of polyethylene pollution.

Chapter 3 presents the experimental details, isolation and identification of microbes and degradation studies used for biodegradation are incorporated. Moreover, procedures used for pretreatment of PE films, optimization of various parameters like pH, temperature, agitation speed etc. have been described. The protocol for the identification of enzymes involved in the biodegradation of polyethylene is also given in this chapter. Analysis of biodegradation has been done by various characterizations like FTIR, GC-MS, SEM, AFM and WCA studies.

Chapter 4 presents and discusses the results of experiments on the biodegradation of High density and Low density polyethylene with fungal microbe. Various parameters responsible for the biodegradation processes were also optimized, efficiency of this microbe is presented and degradation intermediates of HDPE and LDPE are discussed.

Chapter 5 presents and discusses the results of experiments on the biodegradation of High density and Low density polyethylene with bacterial microbe. Parameters like pH, temperature and agitation speed of rotatory shaker has been optimized for the biodegradation processes, Changes in physical, mechanical as well as chemical properties

of polyethylene films have been studied and discussed by WCA, UTM, FTIR and GC-MS in various sections of this chapter.

Chapter 6 presents the biodegradation results and discussions of recycled polyethylene carry bags of different grades by efficient fungal isolate. Optimization of various parameters for the efficient biodegradation process was done. Changes in various properties of films have been analyzed. degradation intermediates have been studied and discussed in various sections of this chapter.

Chapter 7 summarizes the important findings and concludes the present study. It also makes some useful recommendations for further work in this area.

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