

# Preface

Industrialization has improved the living style and economic prospects of the people as well as the country. In the meantime, the toxic pollutants (mainly phenol, phenolic derivatives, dyes, polycyclic aromatic hydrocarbons, etc.) are discharged to the ecosystem by various industries like petroleum, pharmaceutical, paints, and pesticides, and cause environmental issues. The carcinogenic, mutagenic, and teratogenic properties of the pollutants make researchers to explore cost-effective and eco-friendly technology for the degradation of such pollutants. In this direction, the biodegradation process is preferred as an effective tool for the mineralization of xenobiotic compounds.

The adopted microorganisms which have a history of exposure to the contaminated site exhibit higher biodegradation rates than other microorganisms. Hence, the acclimatization and isolation of the potent microbial species can enhance the biodegradation rate. The real-time applications of various microorganisms and packing support have been widely studied for wastewater treatment. However, the continuous performance evaluation of attached-growth bioreactors, such as packed bed bioreactor (PBBR) and moving bed bioreactor (MBBR), are relatively less researched for such applications. The objective of this study is to evaluate the efficacy of the potential bacterial species isolated from a petroleum contaminated site for the biodegradation of phenol and its derivatives in the PBBR and MBBR. In addition, this study employed the low-density polyethylene and polyurethane foam, a packaging waste, in bioreactors for the purpose of bacterial immobilization. A comparative analysis has also been carried out to investigate the performance of PBBR and MBBR operated at identical conditions.

The present thesis is categorized into **5 chapters**. **Chapter 1** embeds the introduction (sources and toxic effect) of phenol and its derivatives, treatment methods, and various

factors affecting the biodegradation process. **Chapter 2** contains a detailed analysis of the literature review, research gaps, and the objective of the thesis work. **Chapter 3** includes the materials and methods of the experimental work. The results and discussions (phenol biodegradation, 4-chlorophenol biodegradation, and comparative study between PBBR and MBBR) are briefly explained in **Chapter 4**. The conclusions of the thesis work and the scope for future work have been mentioned in **Chapter 5**.