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 textile industry-contaminated site for the biodegradation of azo dye and its derivatives in the PBBR and MBBR. In addition, this study employed low-density polyethylene and polyurethane foam, a packaging waste, in bioreactors for the purpose of bacterial immobilization. Process optimize and kinetic study performs in this study.

The present thesis is categorized into **6 chapters**. **Chapter 1** embeds a general introduction (sources and toxic effect) of azo dye and its derivatives, treatment methods, various factors affecting the biodegradation process, and the objective of the thesis work. **Chapter 2** contains a detailed analysis of the literature review, and research gaps. **Chapter 3** Bioremediation of Congo red in an anaerobic moving bed bioreactor: Process optimization and kinetic modeling. **Chapter 4** Biodegradation of Congo red dye using Lysinibacillus species in a moving bed biofilm reactor: Continuous study and kinetic evaluation**. Chapter 5** Biodegradation of Congo red dye using polyurethane foam-based biocarrier combined with activated carbon and sodium alginate: Batch and continuous study in the PBBR. The conclusions of the thesis work and the scope for future work have been mentioned in **Chapter 6**