PREFACE

Industrialization is one of the key aspects of the growth and economic development of any country. The industries such as petroleum, textile, pulp and paper, pharmaceutical, and leather have enormous economic significance due to their involvement in vibrant production output and employment generation. One of the sectors causing excessive environmental concerns is the petroleum and textile industries since they release toxic pollutants such as aromatic hydrocarbons (AHCs) (e.g., benzene, toluene, naphthalene, benzo[a]pyrene), surfactants, heavy metals, dyes, etc. Given their carcinogenic and mutagenic nature, AHCs and dyes reveal direct or indirect health risks to human and aquatic life. The harmful concern of these pollutants (AHCs and dyes) has motivated researchers to develop cost-effective, environmentally benign, and efficient treatment technologies to remove/treat them. In this direction, biodegradation is acknowledged as an eco-friendly and economical approach than physicochemical methods. Although there are lots of research works going on in the field of biodegradation but slow degradation rate is a major challenge.

In the last few decades, it has been observed that the bioreactors (both suspended-growth and attached-growth) play a significant role in the treatment of wastewater which is discharged from various industries, including refineries, textile, leather, and pharmaceuticals. However, the application of continuous bioreactors (specially packed bed bioreactor and moving bed biofilm reactor) is the under-explored area for the biodegradation of Congo red (dye) and naphthalene (AHC). Also, very limited attention has been given to the design and optimization of bioreactors by response surface methodology. The biodegradation rate can also be improved by using acclimatized and isolated potential bacterial species from pollutants-contaminated sites. The main objective of the work is to isolate the dyes and AHCs degrading bacterial species and

used in bioreactors for the effective degradation of dyes and AHCs. The experiments were designed and optimized by response surface methodology to enhance a greater yield with fewer experiments. The performance of the continuous bioreactors was evaluated at various inlet loading rates. The kinetic parameters were evaluated by various substrate growth and inhibition models.

The present study is divided into **7 chapters**. **Chapter 1** contains the introduction of dyes and aromatic hydrocarbons, treatment methods, and bioreactors and their types. **Chapter 2** deals with the literature review on the biodegradation of dyes and aromatic hydrocarbons, research gaps, and the objective of the research work. **Chapter 3** describes the enrichment and isolation procedure of potential bacterial species. Process parameters were optimized by surface response methodology. Further, the performance of an integrated aerobic treatment plant was evaluated at different inlet loading rates. The external mass transfer (EMT) aspect of naphthalene degradation in packed bed bioreactor has been described in **Chapter 4**. **Chapter 5** describes the comparative study of modified carriers in moving bed biofilm reactor for wastewater treatment. In **chapter 6**, the biodegradation of Congo red dye in a moving bed biofilm reactor has been studied. The summary and scope of the future work are described in **Chapter 7**.