PREFACE

In a world increasingly conscious of environmental concerns, the management of textile wastewater has emerged as a pivotal challenge. Rapid industrialization and urbanization have propelled the global textile industry to new heights but have led to the generation of vast amounts of wastewater containing synthetic textile dyes. The indiscriminate emission of textile dyes into our aquatic biota poses a severe threat not only to our environment but also to the very fabric of life that sustains us. The escalating environmental concerns, resource depletion, and health hazards underscore the urgency to address the intricate issues associated with textile wastewater treatment.

This research begins with a description of textile wastewater's severe challenges, addressing the treatment methods including Photocatalysis and Adsorption by using green synthesized nano-photocatalyst, nano-adsorbent, and sustainably produced hydrochar. It refers to a diverse range of green or sustainable synthesis methods that address environmental concerns arising from textile industry wastes. The innovative insights, synergistic approaches, and novel techniques that emerge lay the groundwork for a sustainable future in textile wastewater treatment.

This thesis is divided into **six chapters**. **Chapter 1** embarks on a thorough exploration of the classification of synthetic dyes, their effects on the ecosystem and human health, and a comprehensive elaboration of various textile wastewater remediation techniques. **Chapter 2** ventures into an in-depth literature review, reveals the research gap and lays the foundation for the research objective. **Chapter 3** presents "Green synthesis of TiO_2 nanoparticles using *Tinospora cordifolia* plant extract & its potential application for photocatalysis and antibacterial activity". In **Chapter 4**, the spotlight shifts to "Green synthesis of reduced graphene oxide using *Tinospora cordifolia* plant extract: Exploring its potential for methylene

blue dye degradation and antibacterial activity". As the journey continues, **Chapter 5** delves into the "Adsorption potential of hydrochar derived from hydrothermal carbonization of waste biomass towards the removal of methylene blue dye from wastewater". The concluding chapter, **Chapter 6**, summarizes the findings into a cohesive narrative, and recommendations for future research avenues are laid out.

The culmination of this thesis is not just the completion of an academic endeavor but also the commencement of a broader journey toward a more sustainable and harmonious coexistence with our environment. As the curtain rises on this journey, I extend my gratitude to all those who have played a role in shaping this research.