Preface

This thesis explores the pyrolysis of torrefied *Acacia nilotica* in a tubular fixed-bed reactor under nitrogen environment. The process was optimized using response surface methodology coupled with central composite design, in order to obtain the maximum yield of pyrolysis oil. Due to the fast-growing population, technological advancement and higher standard of living of people, demand for energy as well as the price of fossil-derived fuels like petrol and diesel are increasing. Also, the fossil fuel reserves are neither sustainable nor clean sources of energy. Among the available renewable sources of energy, incidentally, biomass has gathered significant attention due to its copious amount, low market value, and carbon neutrality. However, biomass is associated with many inherent shortcomings like higher moisture content, lower higher heating value, higher O/C and H/C ratio and hygroscopic nature, which makes biomass inferior to fossil derived fuels.

So, I decided my research objective to pretreat the biomass using torrefaction process and then preform the pyrolysis of treated biomass. The physicochemical characteristics of products from pyrolysis of treated and raw biomass were compared. Finally, the efficacy of biochar from treated and raw biomass was tested towards removal of aqueous methylene blue.

I express my deep sense of gratitude and indebtedness to my esteemed supervisors **Dr. Jyoti Prasad Chakraborty** and **Prof. Monoj Kumar Mondal**, for their guidance and encouragement during the PhD dissertation work.

So, it is hoped that this PhD work will help to understand the integrated torrefaction-pyrolysis process for better utilization of biomass as source of energy. For ease of understanding to the readers, this thesis has divided in eight chapters.

Satyansh Singh