Preface

In the last few decades, many countries are facing the acute problem of water. The available freshwater are highly contaminated due to anthropogenic activities. The industries such as leather tanning, cement, mining, textile, dye manufacturing, paper, inorganic chemicals, wood treatment units, metal, fertilizer, and photography, etc. are responsible for water contamination due to presence of heavy metals and dyes in the effluents. These effluents cause severe environmental and health issues and considered as one of the major challenge to researchers. Continuous research is going on to develop less expensive and efficient adsorbent. Therefore the present work is to find out a suitable and effective adsorbent using locally available agro-waste which is abundantly available. However, very limited research articles are available on almond shell and mango kernel agro-waste for preparation of activated carbon by chemical activation.

In present study, activated carbons were prepared from mango (*Mangifera indica*) seed kernel and almond shell by chemical activation with H_3PO_4. The prepared activated carbons were characterized by FTIR, SEM, BET, and CHNS analysis. FTIR analysis showed the different functional group on the surface of prepared activated carbon. SEM image showed the porous structure and BET analysis demonstrated the large surface area of activated carbon. Above material showed its suitability for the removal of Cr (VI) and Methylene blue dye. Further, kinetic study was done by different models such as pseudo-first order, pseudo -second order and intra particle diffusion model. Isotherm study was also done with four different models such as Langmuir, Freundlich, Tempkin and Dubinin–Radushkevich isotherm. The thermodynamic parameters such as Gibbs free energy (ΔG°),

enthalpy change (ΔH°) and entropy change (ΔS°) were also determined to find out the feasibility of adsorption.

The thesis entitled, "**Preparation of activated carbon from agro waste and it's use for removal of heavy metals and dyes from aqueous phase**" comprises 5 chapters and references.

Chapter 1contains the background and motivation for the thesis and outlines the objectives of the research and the methods used. This chapter presents an introduction to different methods for preparation of activated carbon by different agro waste.

Chapter 2 includes literature review for different heavy metals and dyes removal by different absorbent at various operating condition. The results of adsorption capacity, surface area are compared.

Chapter 3 describes the preparation of activated carbon by mango seed kernel and almond shell by chemical agents. The chemically impregnated raw agro waste is carbonized in muffle furnace. In this chapter we have also described the adsorption isotherms, kinetics model and thermodynamic study, which has been used in this study.

Chapter 4 shows the result of prepared activated carbon for the removal of hexavalent chromium and methylene blue. The different operating parameters have been investigated on the removal efficiency of metal and dye from aqueous phase. The effect of solution pH, contact time, initial concentration of adsorbate, adsorbent dose and operating temperature has been performed to get the optimum value of these parameters. Chapter 4 has been classified in three sections. The section- A shows the characterization of mango seed kernel activated carbon and performance for the removal of hexavalent chromium at different

operating parameters. The section -B shows the effect of almond shell activated carbon for the removal of hexavalent chromium Cr (VI) by prepared almond shell activated carbon at various operating parameters. The section- C shows the effect of prepared almond shell activated carbon for the removal of methylene blue dye. The adsorption isotherm and kinetics study was also done to investigate the best model which satisfied our experimental data. The thermodynamic study was also done to find out the feasibility of adsorption.

The thesis is summed up in **Chapter 5** under Conclusions. The valuable experiences gained as a result of the work done for this thesis are discussed.