PREFACE

This investigation entitled, “Kinetics and Equilibrium Studies on the Removal of Dyes by Adsorption onto Activated Carbons Prepared from Tree Leaves” was carried out by me on the basis of part time research work in the Department of Chemistry, Aditanar College of Arts and Science, Thiruchendur-628 216, India under the supervisions and guidance of Dr. N. KANNAN, M.Sc., Ph.D., Associate Professor, Department of Chemistry (P.G), Ayya Nadar Janaki Ammal College (Autonomous), Sivakasi, India and Dr. P. Subramaniam, M.Sc.,Ph.D., Head & Associate Professor in Chemistry, Aditanar College of Arts and Science, Tirchendur 628 216, Tamilnadu, India. The results of the studies are being submitted in the form of a thesis to Manonmaniam Sundaranar, Tirunelveli 627 012, India for the award of degree of Doctor of Philosophy.

In this thesis the figures, equations and tables are indicated by double number, the first part of which represents the chapter in which they are described and placed and second part represents its distinction. Standard abbreviations are used in the thesis and wherever necessary they are explained in the text. A separate list of abbreviations is also included.

Dyes present in water and wastewater are highly toxic and hence they are to be removed. The removal of dyes Malachite Green (MG), Rhodamine-B (RB) and Crystal Violet (CV) has been studied by adsorption on commercial activated carbon (CAC), indigenously prepared activated carbons (ACs) from tree leaves such as Casurina Equisetifolia (CE) Tectona Grandis (TG), Artocarpus Heterophylys (AH), Pongamia Pinnata (PP), Madhuca Longifolia (ML) and Terminalia Catappa (TC). The physico-chemical, textural (SEM studies), spectral (FT-IR) studies and thermal degradation (TGA studies) characteristics of adsorbents and dye loaded adsorbents
have been studied. Adsorbents are found to be porous, thermally stable and possess high surface area and hence they are suitable materials for adsorption studies. The batch type adsorption experiments were carried out at 30 ± 1 °C in order to study the effect of various process parameters such as initial concentration of dye, contact time, dose, particle size of adsorbent initial pH and ionic strength.

The adsorption data were modelled with Freundlich, Langmuir, Redlich-Paterson isotherms BET and kinetic equations (Natarajan - Khalaf, Lagergren (first and second order) and Bhattacharya - Venkobachar equations) intra-particle diffusion model etc. The isotherm and rate constants have been computed, analysed and discussed. The adsorption of dye is found to be a first order process with intra-particle diffusion as one of the rate determining steps. The optimum conditions for the cost-effective and efficient removal of dyes by adsorbents have been obtained. The adsorption capacities of adsorbents relative to that of CAC have also been determined.

The adsorption of dyes from binary mixtures has also been studied. SRS isotherm is found to be useful to predict the adsorption behaviour of dyes from binary mixture.

It is concluded from the present study that, the indigenously prepared ACs from tree leaves could be used as low cost adsorbents for efficient and cost-effective water and wastewater treatment process, especially for the removal of dyes. The results of the present study will be highly useful in designing cost-effective water and wastewater treatment plants. I strongly opine that this present research contribution in the field of water and wastewater treatment by adsorption process, will be highly helpful to the scientists, technologists, industries, society and to the public, in future.

Towards a colourful and cheerful life with colour free environment...

A.Vijayakumar