Thesis Title: Environment Friendly Approach for Water Treatment: Biosorption and Sonochemical Routes

Name: Aditi Mullick (14CH91R02)

ABSTRACT

In this thesis, an effort was given to present the current research trend in wastewater treatment that is on demand in terms of some emerging technologies at the replacement of conventional methods. The usage of ample amount of chemicals as well as high energy consumption are some of the major constraints of conventional methods. Hence, increasing environmental concern is driving the researcher to adopt more effective, low cost and environment friendly methods.

The first objective was to apply bio-sorption as a cost effective and sustainable method for dye removal from the water. The bio-sorbent was synthesized from the spent stevia leaves after the extraction of *stevioside*, which is used for preparing natural sweetener, followed by chemical activation and carbonization of the waste material. It was successfully exploited for the adsorption of Malachite Green (MG) dye from the water. The rapid uptake of the dye at almost neutral pH and high renewable capacity made this bio-sorbent an attractive alternative to the commercial ones.

In second objective, composite materials were synthesized by impregnating different metals on activated carbon using sonochemical method and applied for fluoride adsorption. The uniqueness of sonochemical method for developing the composites was the fast reaction rate aided by the free hydroxyl radicals generated during acoustic cavitation. It accelerated the hydrolysis of the metal salts in the aqueous medium and helped them anchoring on activated carbon. The dramatic reduction in the reaction time helped in saving a substantial amount of energy during synthesis.

The unique conditions generated in the medium during cavitation made ultrasound as a promising way for controlling algal growth in water bodies by damaging the cells. In the third objective, an initial study was done to see the response of different algal species grown in pure culture at laboratory towards ultrasonication. In later stage, water sample was collected from an oxidation pond where algae was grown in open atmosphere along with other microorganisms. Interesting part was to see how they response to ultrasonic treatment in presence of other microorganisms. The effect of treatment on growth rate, photosynthesis process and to the extent of cell membrane damage were studied.

Keywords: *Water treatment; Bio-sorption; Ultrasound; Acoustic cavitation; Composites; Fluoride removal; Algal biomass*