Preface

This thesis is an outgrowth of my knowledge to understand the current scenario regarding various processes adapted for simultaneous removal of sulfur dioxide (SO_2) and nitric oxide (NO), and to explain most suitable technique which can be applicable to the process in cost-effective and eco-friendly manner. The work presented in this thesis has been broadly divided into 6 chapters.

Chapter I explains the importance of the requirement to adapt for simultaneous removal of SO_2 and NO. It furnishes the various available sources of SO_2 and NO emission from natural and man-made emissions to the environment. The detailed overview of these toxic gases SO_2 and NO and their effects were summarized. The current available technologies for individual SO_2 and NO removal were given in this chapter. The elaborated mechanism in the aspect of combined removal of SO_2 and NO along with classification of different techniques was summarized in this chapter. This chapter also elucidates the origin of the problem and the objective of the process.

Literature summarizes that many technologies have been used regarding the aspect of simultaneous removal of SO_2 and NO_x from gas streams. Among various technologies, wet scrubbing with the use of absorbent has a leading role due to cost effectiveness and optimistic results for SO_2 and NO removal. **Chapter II** describes the literature on adapted technique absorption of SO_2 and NO for gas stream. It includes the summary of the absorbents along with the investigated operating parameters of the process. The outline of the process flow sheet was introduced to understand the major steps of the process carried out by researchers.

The necessary reactions of the process were also given in this chapter as available in literature.

Chapter III elaborates the experimentation of the process for simultaneous removal of SO_2 and NO. The details of the used equipments/instruments and with dimensions and their sources were given. The reagents used for the process were tabulated with sources and their purity. The three different columns used in the process along with their specifications were summarized. Initially the performance of bubble column using NaClO as absorbent was discussed along with experimental procedure for simultaneous removal of SO_2 and NO under various operating parameters. The process was followed by experimentation in the semi batch magnetic stirrer vessel with NaClO, $Ca(OCl)_2$ and NaClO/NaOH as absorbents for simultaneous removal of SO_2 and NO under various conditions. Then experimentation with suitable absorbent NaClO to see the effect of various parameters on simultaneous SO_2 and NO removal for continuous study using spray column was provided. The effect of additive NH_3 to NaClO was experimented for simultaneous removal of SO_2 and NO in semi batch and continuous operation.

Chapter IV explains the results for the experimentation carried out using various absorbents in the different columns. The major study was concerned about analysis of the removal efficiency of SO_2 and NO for various feasibility parameters such as, contact time, absorbent concentration, absorbent temperature, pH, initial SO_2 concentration, initial NO concentration, etc. Effect of CO_2 addition in the inlet gas stream on simultaneous removal of SO_2 and NO was also carried out for fixed operating conditions. The detailed process mechanism for suitable absorbent was given in this chapter. A study on mass transfer mechanism and kinetics of the reaction involved in simultaneous absorption of SO_2 and NO

in NaClO solution was illustrated. The calculation for reaction order and reaction rate constant for NO absorption in NaClO solution was given along with the mass transfer coefficient for the absorption of SO_2 in NaClO solution in this chapter. The calculated thermodynamic properties such as enthalpy change, Gibbs free energy, equilibrium constant and equilibrium partial pressure for the process to check the feasibility of the process were also included in this chapter.

Chapter V gives the proposed feasible method based on the results obtained in the work for simultaneous absorption of SO_2 and NO. The use of spent absorbent after NaClO/NH_3 scrubbing as fertilizer for preparation of bio layer around the power plant was also demonstrated in this chapter.

Chapter VI summarizes the conclusion drawn on the basis of present work process with different columns such as bubble, stirred vessel and spray column. The recommendations for the future work were also given in this chapter.