ABSTRACT

The modern living style of human community has improved significantly through the development of a wide range of industries along with the invention and production of many useful products. This vigorous industrial development has led to many undesirable outcomes too. Particularly, some industrial sectors have started to impose serious burdens on the natural environment. One among these industrial sectors is foundry. Foundries produce casting of the components made of different metals. While processing, foundries melt metals and pour the molten metal’s into cavities of desired shape. During this process, large amount of pollutants are emitted into the environment causing imbalance of the ecosystem. This imbalance has resulted in the increased contamination of air, water, and soil with pollutants such as non-degradable toxic metals and flue gases. This kind of situation is widely observed in highly industrialized countries. In this background, research activities are actively pursued to offer solutions for enabling the foundries situated in industrialized countries to function effectively but without causing any damage to the environment.

Foundry industry is known for the emission of powder particles (these powder particles are often called as dust), emission of gaseous pollutants, inadequate treatment and disposal of the solid waste, emission of polluted waters without any treatment and low level of energetic efficiency time and again policies have been formulated by the governments in most of the developed and developing countries around the world for aiming to reduce
emissions from the industrial activities. These policies have been driving these countries to formulate laws for preventing emissions from industries. In the case of foundry industry, in spite of the emergence of these laws, emission of pollutants has not been under stipulated levels. Meanwhile, during the recent years, foundries have been adding new technologies to prevent the emission of pollutants. However, the performance of these pollution preventing technologies needs to be investigated. Particularly, the impact of utilizing these Pollution Controlling Devices (PCDs) in iron foundries needs to be investigated.

Two reasons favour to focus investigations on iron foundries. The first reason is that, iron foundries produce higher quantities of casting compared to that are produced by the other metal foundries. The second reason is that, iron foundries emit higher amount of pollutants that affect more the environment than the other foundries producing casting of metals other than iron. In this background, the doctoral work reported this thesis was carried out. During this doctoral work, the impact of utilizing PCDs in the iron foundries situated in Coimbatore district of India was investigated. Further, the impact of two pollution prevention devices namely wet scrubber and cassette filter in two different iron foundries situated in Coimbatore was compared.

The doctoral work reported in this thesis was begun by surveying the literature to identify the research outcomes on utilizing PCDs in foundries. The results of this literature survey favoured the concentration of research activities in controlling pollution in iron foundries. Although relatively less
number of researches on controlling pollution is reported in literature arena, the information derived by conducting this literature survey are highly useful to the engineers and managers who are working in iron foundries. One of such useful information derived by conducting literature survey is that, the usage of induction furnace to melt the metals in iron foundries leads to the efficient controlling of the pollution. Another useful information gathered by conducting this literature survey is Pollution control levels indicated by European standards and the role of pollution control boards in India.

After conducting the literature survey, 25 iron foundries located in Coimbatore district were approached with a questionnaire to gather information about practically utilizing PCDs in iron foundries. After checking the data, the data received from 21 of these iron foundries were utilized for carrying out investigations. The results of conducting investigations using the data gathered from 21 iron foundries located in Coimbatore district led to the finding that, the use of induction furnace for melting metals in iron foundries will reduce the emission of pollutants. This finding corroborated with the information derived by conducting the literature survey. Another finding was that, cassette filter is the most efficient and economical device that can be used for controlling pollution in iron foundries. Subsequently investigations on utilizing sand filtration techniques for reducing pollution while using wet scrubber in iron foundries were conducted by employing computational fluid dynamic software package. Since the construction and working of cassette filter have not been documented in literature arena, the information on the same was gathered from the iron foundry in which the cassette filter is
utilized. Subsequently, the information on the construction and working of cassette filter was documented.

The overall results of conducting the doctoral work reported in this thesis favoured the usage of induction furnace in place of cupola furnace to control pollution in iron foundries. Further the results of conducting this doctoral work revealed that, the cassette filter is the efficient and economical PCD. It is suggested that, the practitioners and academicians need to work together jointly for motivating modern foundries to implement the findings of the doctoral work reported in this thesis. After reporting this doctoral work, this thesis is concluded with the suggestion to carry out numerous doctoral works by the future researchers to evolve improved and economical versions of cassette filter that would enable the iron foundries to perform at zero pollution level.