A Review on the Importance of Implementation of the Green Technology in the Small and Medium Scale Foundry in India

Gajanan Patange[1] Mitesh Patel[2]
[1,2]Student
[1,2]Department of Mechanical Engineering
[1,2]Charotar University of Science and Technology, Changa

Abstract— The Green Technology is the knowledge for conserving natural environment and resources and reducing human involvement. GT can operate in diversified areas such as bio-fuel, eco forestry, renewable energy, and solid waste management. Green technology is broadly defined as technology that, when properly implemented, allows an organization to meet its present needs without compromising its future needs. The minimization of emissions, efficient raw material and energy usage, the recovery and recycling of waste and the substitution of harmful substances, are an important principles of the "Green foundry". The overall objective of the study is to conduct feasibility study by summarizing the overview of the status of the application of green technology (GT) in selected foundries. The objective of feasibility studies is to transform a project idea into a specific plan, identifying and comparing alternatives with a view to developing different approaches to satisfying a need and implementing the original idea.

Key words: Green technology, foundry industry

I. INTRODUCTION

In recent decade, there has been increased pressure on manufacturing companies to think beyond the economic benefits of their process and products and consider the environmental and social affects. [1] Toxic wastes and acid precipitation created by foundry industry are causing crisis for thousands of communities around the world. Even more ominous, global crises such as ozone depletion, greenhouse warming, deforestation and the loss of biodiversity are in one way or another rooted in corporate products and production systems. These environmental problems are sounding an alarm for the public. People are concerned about environmental degradation and worried about the continued functioning of the Earth's natural systems. The environmental liabilities we are leaving behind for the next generation may be more than they can handle. To address these concerns we need new economic and organizational concepts and practices.

Foundry sector in which casting technology is applied to process and give shapes to metals is one of the major industry sectors. Casting is used for various products from jewelry to manufacturing of heavy industry products. Foundries have long looked at themselves as the nation's recyclers. Since metals were first poured, it was recognized that recycling old iron castings was the easiest manner to remake another casting and reuse society's unwanted cast articles. Later steel and other metal scrape was introduced into our change mixes as an additional feedstock to achieve the same goal. Today because of recycling of metals, most foundries have long considered themselves as a part of green technology, but in reality foundry industry has yet to achieve the higher level of sustainability that the future will demand. The pollution related to foundries are important due to their high potential risk to environment and human health. The main waste from casting is the spent foundry sand, which is generated at very large quantities during core and mold preparation. [2]

A. Green Technology:

Green technology is broadly defined as technology that, when properly implemented, allows an organization to meet its present needs without compromising its future needs. Green technology can include energy and material waste reductions in the manufacturing process and the use of alternative manufacturing technologies with the least impact to human health, the earth and its natural resources. Evolution, methods and materials used to amend and configure equipment to get better function or cleanness without problem.

B. Green Foundry:

The minimization of emissions, efficient raw material and energy usage, the recovery and recycling of waste and the substitution of harmful substances, are an important principles of the "Green foundry". For foundries, the focal points are air emissions, the efficient use of raw materials and energy, and waste reduction, in conjunction with any recycling and re-use options.

II. LITERATURE REVIEW

R.Krishnaraj, Dr.M.Sakthivel, Dr.S.R.Devadasan, K.Kanthavel, E.Balaji, J. Arulmani [3] evaluated the stack emmision and ambient air quality of dust collector in foundry. Suspended Particulate Matter was analyzed along with SO_2, NO_2 and CO hence its level was found to be appropriate with all the locations of sampling stations. The factors affecting dust concentrations were also discussed along with results. They give the design detail for induction furnace stack and also for wet scrubber with guideline to select dust collector.

R.Krishnaraj, Dr.M.Sakthivel, Dr.S.R.Devadasan[4] have collected samples of dust emmisions from induction furnace using wet scrubbers for one year and performance were plotted for their distribution for differents months in different locations and performance of wet scrubber was also been discussed.

Hardik Patel, Gajanan Patange [5] said that the emission of foundry is depends upon iron coke ratio**,** temperature, specification blast rate, diameter of cupola furnace**,** coke characteristics**.** They also give their conclusions and recommendations on design of cupola furnace on the basis of the data they collected and analysis.

Li Yuanyuan, Chen Weiping, Huang Dan et al [6] carried out multidimensional analyses and evaluation on the potentials in the energy conservation and emmision reduction and proposed various kinds of analyzing models and also discussed the differences and similarities of them

between china and other countries and pointed out future development trend. They paid big attention to 3R principle (Reduce, Reduction and Reuse).

Borut Kosec, Sandra Sensic Mirko Sokovik [7] conclude that waste management in foundries is gaining a higher ecological and economical importance. From the sustainable development point of view also it is most suitable because of ensurity of material utilization and wasted matters can be used in other ways and reduction in consumption of natural renewable or non renewable sources.

Dushyant Bhimani, Prof. Jayesh Pitroda, Prof. Jaydev Bhavsar[8] have done limited experimental investigation concerning the water absorption and compressive strength of concrete, gave observations such as: 1.The water absorption decreased up to 50% replacement of fine aggregrate by used foundry sand. 2. Compressive strength is increased compared to traditional concrete. 3. Environmental effects from wastes and disposal problems can be reduced.

R. M. Torielli, R. A. Abrahams, R.W. Smillie and R.C. Voigt [9] reviewed two specific technologies which both improve cost and reduce environmental impact for foundries were. A set of proven, effective lean tools and techniques that can assist foundries in their sustainability efforts. The synergy between lean and green efforts provides the foundry industry a clear pathway and framework to become economically and environmentally sustainable.

Mats Holmgren and Peter Naystrom [10] conclude" The minimization of emissions, efficient raw material and energy usage, the recovery and recycling of waste and the substitution of harmful substances, are an important principles of the "Green foundry". For foundries, the focal points are air emissions, the efficient use of raw materials and energy, and waste reduction in conjunction with any recycling and re-use options.

Ali Akbar Mottahedi, Saeid Amani [11] said to reduce the carbon content of molten steel oxygen gas is blown with a lance in most of the EAF. However in this project, the main purpose is to produce heat with adding more coke to the molten steels and burned that extra coke with more oxygen. Blowing oxygen into the furnace to a foam slag alleviates the problem that creates bubbles of CO2, which percolate up into foam. The arc is down in the foamy slag. Therefore, the heat is absorbed by the slag instead of moving out to the walls of the vessel and the slag heat is transferred to the molten metal. The data of steel making melting electric power consumption in the 12-ton EAF are compared. It is obvious that, the average electric power is reduced from 8.226 MWh to 6.40 MWh or 22 %. This result conclude that it can reduce the electric power consumption of steel making in Electric Arc Furnace up to 22percent by adding coke and oxygen bellowing to the furnace. It will save the fee of energy.

P.Kumar & Dr. N. Mohan Das Gandhi [12] introduce a Green Manufacturing in foundry. A number of initiatives are being taken by companies in India in the areas of regulation and reduction of green house gases, discharge of pollutants and emissions, hazardous waste management, and energy conservation to pave the way for a cleaner and greener environment for sustainable development. Manufacturers are able to save costs on the final product by reducing energy and materials wastes. Beyond good business, a green manufacturing program benefits the environment and creates value for the customer. Three major model of advanced green systems are Green Management System (GMS), Green Waste Reduction Techniques (GWRT) and Green Results (GR). This paper will target reducing traditional lean wastes along with energy and material wastes in metal casing facilities and study was undertaken to estimate the pollutants released from the foundries. They concluded Lean system infrastructure serves as a catalyst to the successful implementation of Green best practices and the achievement of corresponding Green Results. The evidence that plants with Lean systems yield higher Green Results. Structural Mortar and concrete can be manufactured with used foundry sand as a partial replacement of natural sand. A suitable recycling of the discarded foundry sand as building construction material could be suggested. The goal is to allow manufacturers to balance environmental concerns with profitability. Attractive incentives to individuals and industries and measures for clean technologies by the government is probably the only way to foster a vibrant green economy.

G. S.Patange, M.P.Khond, H.J.Rathod & k. B. Chhadva [13] said that Reclamation of sand can be under taken using number of techniques, most of the foundries in India use mechanical reclamation. By proper investigation of mould making, mould box size, sand mixture, better process control, sand spilling throughout the process, General housekeeping foundry management can enhance performance of their system by critical examination. Also there is scope for thermal reclamation system in small and medium scale foundries in India, due to some advantages such as ; Stronger molds and cores with less chemical additives , Better surface finish and less porosity, More dimensionally accurate castings, Far less odor and smoke in the foundry during pouring because less chemical binder is needed. With fewer chemical additives and a Superior quality of sand grain, casting defects such as finning and burn in are reduced.

Nikol pirutová, Jaroslav Beòo, Vlasta Bednáøová [14]said utilization of the sand waste in a circulation system of a foundry moulding sand is one of the many ways of reducing wastes of a foundry production. There is a very significant problem as to how this waste can affect the technological properties of a foundry moulding mixture (green-sand system) during its circulation. The aim of this contribution is to determine the impact of the selected core systems (COLD-BOX, HOT-BOX, CRONING, CO2 – RESOL) on the bentonite moulding-sand properties. For the purpose of this research an "uncirculated" moulding mixture was used. At laboratory temperature, a slight increase in certain strength (e.g., the green compression strength after an addition of the CB cores) was obtained. On the other hand, an addition of the CRONING and RESOL cores caused a decrease in the sand mechanical strengths. The core addition exhibits a negative impact on the wear, especially for the GGS system with the CB cores. After a thermal exposure a significant decrease in the sand properties was observed. It was probably caused by a formation of the pyrolytic-carbon films on the grain surfaces (a deactivation of the bentonite); this assumption was confirmed with an EDX analysis of the sand samples. An extension of the sample preparation time (from 6 min to 12 min) caused an increase in the mixture mechanical

properties (strengths), probably due to an activation of the passive bentonite.

R. Masike, M.J. Chimbadzwa [15] reviewed how sand casting foundries can implement Cleaner Production and benefit from the created conducive environment as well as saved financial capital. The review gave an overview of the environmental aspects and impacts of foundry operations. It also outlined best practices to improve the energy, material, and environmental efficiency, and the product output of the operation. The current environmental status and performance of foundry companies in Zimbabwe was determined from the initial environmental review, energy and environmental audits. Once the environmental status was established, Cleaner Production options were then modelled. The feasibility of the options were also analysed, and life cycle analysis of casted products was carried out. The researchers concluded that raw materials, water, and energy were to be saved if foundry companies implemented Cleaner Production options. The purpose of this paper was to assist foundries in pollution prevention by devising clean technologies which maintain or improve the quality of the ambient surrounding. The paper used Cleaner Production and its opportunities to minimize material consumption, optimize production yield and to prevent polluting the air, water and land. CP has proven in practice to be a very valuable concept for abating industrial wastes and emissions. Economic benefits can be achieved from preventing waste and emissions in the first place, as raw materials, energy and water are saved and waste disposal costs are minimized. The aim of the project was to model CP options which enable the efficient use of resources and improve the environmental performance of foundry companies. The benefits of implementing CP at foundry companies were discussed.

III. CONCLUSION

From the study uptil now we can conclude that the minimization of emissions, efficient raw material and energy usage, optimum process chemical utilization, the recovering and recycling of waste and the substitution of harmful substances are all important principles of the "Green Foundry". For foundries, the focal points are air emissions, the efficient use of raw materials and energy, and waste reduction, in conjunction with any recycling and re-use options.

The benefits of implementing GT at foundry companies were ascertained, these include;

(1) Reducing waste through efficient use of energy and raw materials.
(2) Enhancing productivity and increasing product yield through greater efficiency.
(3) Increasing profitability and quality of products.
(4) Reducing the risks of environmental accidents and avoiding regulatory compliance costs leading to insurance saving.

The resemblance of Green Technology are:

(1) Cleaner Production
(2) Pollution Prevention
(3) Waste minimization

REFERENCES

[1] Che B. Jounga, John Carrell and Prabir Sarkara. Categorization of indicators for sustainable manufacturing. Elsevier Ecological Indicators 24 (2012) 148–157.
[2] Yiigit Cisem. Life cycle assessment in ferrous foundry industry, January 2013
[3] R.Krishnaraj, Dr.M.Sakthivel, Dr.S.R.Devadasan, K.Kanthavel, E.Balaji, J.Arulmani "A Journey towards Green Revolution- A case study of foundry" International Journal of Scientific & Engineering Research Volume 2, Issue 7, July-2011 ISSN 2229-5518
[4] R.Krishnaraj, Dr.M.Sakthivel, Dr.S.R.Devadasan "performance efficiency of wet scrubber in induction furnace towards green revolution- a case study Indian foundry" , Journal of Environmental Research And Development Vol. 6 No. 3A, Jan-March 2012(824-833),
[5] Hardik Patel, Gajanan Patange" Investigation of Pollution Emits By Cupola Furnace in Gujarat Foundry", international journal of engineering trends and technology (ijett) - volume4, issue5-may 2013 ISSN: 2231-5381
[6] Li Yuanyuan, Chen Weiping, Huang Dan et al "Energy conservation and emissions reduction strategies in foundry industry" The 69th WFC Paper, Vol.7 No.4, Nov-2010(392-399)
[7] Borut Kosec, Sandra Sensic Mirko Sokovik "Foundry Waste Management", International Journal for Quality research , Vol.2, No. 2, 2008 (129-133),
[8] Dushyant Bhimani, Prof. Jayesh Pitroda, Prof. Jaydev Bhavsar" used foundry sand: opportunities for development of eco-friendly low cost concrete" International Journal of Advanced Engineering Technology E-ISSN 0976-3945, IJAET/Vol. IV/ Issue I/Jan.-March., 2013/63-66,
[9] R. M. Torielli, R. A. Abrahams, R.W. Smillie and R.C. Voigt," Using lean methodologies for economically and environmentally sustainable foundries", The 69th WFC Paper, February 2011, Vol.8 No.1 (74-88),
[10] Mats Holmgren and Peter Naystrom. "The Green Foundry", 68th WFC - World Foundry Congress 7th - 10th February, 2008, (15-17)
[11] International Journal of Chem Tech Research ISSN: 0974-4290, Vol.1, No.1, pp 62-70, Jan – March 2009,
[12] P.Kumar & Dr. N. Mohan Das Gandhi "Green Manufacturing in Foundry" International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 11, November – 2013 ISSN: 2278-0181, 1203-1207
[13] G. S. Patange, M. P. Khond, H. J. Rathod & k. B. Chhadva Investigation of foundry waste sand reclamation process for small and medium scale Indian foundry. "International Journal of Industrial Engineering & Technology (IJIET) vol3 issue 1 march2013 p.p.1-6

[14] Nikol [pirutová, Jaroslav Beòo, Vlasta Bednáøová "alternative utilization of the core sand for a green-sand system"
[15] R. Masike, M.J. Chimbadzwa, "Cleaner production options in sand casting foundries" International Journal of Sustainable Energy and Environment Vol. 1, No. 3, April 2013, PP: 25 - 47, ISSN: 2327-0330

