A Review On Aluminium Die Casting Industrial Waste Management

Swati.N.Nasipude
Master of Technology
Department of Technology Shivaji University
Kolhapur, India

Saniya Bagwan
Master of Technology
Department of Technology Shivaji University
Kolhapur, India

***Abstract*—The die casting industry uses water to cool and carry lubricants to their metal casting dies, and some of the water drips onto the plant floor. Die-Casting (Lester) is generating a complex wastewater stream from their manufacturing operation consisting of various oils, hydrocarbons, heavy metals, and silicones that make it unsuitable for direct discharge to the environment. The treatment of manufacturing wastewater requires a simple, rugged and durable treatment process. The system must be capable of handling a wide compositional range, and varied concentrations, of wastewater components and still consistently provide purified water suitable for reuse or discharge. An existing treatment process is currently being used to treat this water which consists of a bio digester, tubular ultra-filter and reverse osmosis system. Contaminants in the feed stream cause a number problems including fouling of the surface of the ultra-filter and reverse osmosis systems. Fouling of the membranes translates to inconsistent unreliable system operation coupled with excessively high operating costs.**

Keywords— Die casting, hydrocarbons, heavy metals, pollution control, environmental impact

I. INTRODUCTION

Die casting is a metal casting process that is characterized by forcing molten metal under high pressure into a mold cavity. The mold cavity is created using two hardened tool steel dies which have been machined into shape and work similarly to an injection mold during the process. Most die castings are made from non-ferrous metals, specifically zinc, copper, aluminium, magnesium, lead, pewter and tin based alloys. Depending on the type of metal being cast, a hot- or cold-chamber machine is used.

The casting equipment and the metal dies represent large capital costs and this tends to limit the process to high volume production. Manufacture of parts using die casting is relatively simple, involving only four main steps, which keeps the incremental cost per item low. It is especially suited for a large quantity of small to medium-sized castings, which is why die casting produces more castings than any other casting process. The metal die casting industry contributes to air pollution problems through emissions of gases that contribute to acidification, human toxicity problems and global warming among other environmental problems. Aluminium pressure die casting also contributes to a number of environmental problems. It is in particular a source of metal emissions to the environment that may be toxic to humans and other organisms. Awareness of the need to reduce these environmental problems has been growing.

II. LITERATURE REVIEW

Belmira Neto et al., (2009) this study explore a model (MIKADO) to analyse scenarios for the reduction of the environmental impact of an aluminium die casting plant. This model calculates the potential to reduce emissions, and the costs associated with implementation of reduction options. They e analysed seven types of reduction strategies, assuming the simultaneous implementation of different reduction options. These strategies are analysed with respect to their potential to reduce emissions, environmental impact and costs associated with the implementation of options. These strategies were found to differ largely in their potential to reduce the environmental impact of the plant.

S.N. Ab Rahim et al., At present of the manufacturing sector, which is at the economic level, must be made to sustain societies in the high living by industrial societies and able to increase productivities so that they are able to achieve the same standard of living equally. It will be a big issue because recycled materials have become very important to environmental. This paper presents an overview of the trends and the concept of emerging to identify the recyclability contents of the product for recycling aluminium chips by the hot extrusion process. It shows that even though to achieve the sustainability, it needs the holistic optimization of the entire environment. Extrusion technology research is continuously improving which mainly focused to attain of the optimum mechanical and physical properties and also modelling and optimization of the extrusion parameters.

Gang Liu et al (2012), this article discusses the state of the practice, strength, and weakness of life cycle assessments (LCA) for achieving sustainability goals in the aluminium industry. Notable features of the reviewed LCAs include a limited geographical and life cycle scope and differentiated system boundaries, a common practice to use industry-wide inventory data, a polarized debate on allocation of aluminium recycling, and a predominant focus on energy and greenhouse gas emissions environmental metrics. Not surprisingly, the various studies have produced significantly different results, e.g., the greenhouse gas emissions per kilogram primary aluminium production range from 5.92 to 41.10 kg CO2-equivalent and the “break-even point” (the point when the fuel economy benefits of the lighter aluminium vehicle offset added emissions from the production stage) of vehicles light weighting ranges from 50,000 to 250,000 km. These variations relate not only to real world differences (e.g., temporal and geographical characteristics), but also partly to data uncertainties and methodological choices. Particularly, the

recyclability, long lifetime, and environmental benefits in the use phase of aluminium pose great challenges for LCA methodology, especially for the allocation of recycling. The identified uncertainties and deficiencies can serve as an important base for further improvement of subsequent LCA applications in the aluminium industry.

Jefferson O. Gomes (2011), studied to determine the reuse conditions of treated waters from coolant in the composition of sand cast process. The conventional treated water from coolant is not allowed for reusing purpose, due to the poor efficiency of the usual treatment processes. Treated water contains harmful elements that are extremely difficult to degrade in a foundry sand mix. In this work, three technologies of effluent treatment were evaluated. Tests were performed to verify the efficiency of emulsions prepared m different types of water in order to access the feasibility of water reuse derived from emulsions discarded after the machining process.

Eric S. Peterson et al., studies have shown that active surface ultra-filtration membranes can reduce total metals in a die casting waste solution. The metals concentrations are reduced significantly, while several (lead and copper) become detectable with increasing concentration of the original solutions. The metals were found to increase in concentration in the concentrates probably indicating that they preferred to stay with the organic components of the die casting solutions. The active surface membranes were observed to exhibit less fouling tendency than the non-active surface systems (in the timeframe of these experiments - longer-term pilot studies are needed to evaluate this point). The fluxes of the active surface membrane were consistently higher and more stable than non-active surface membranes tested.

Hirobumi Ohiraet al., carried out work on the water-Based Die lubricants (WBD) are widely used in the world. A new generation of Water Free Releasing (WFR) agent containing no water overcame the disadvantages of WBD in 2004. Because of very small amount of spray (1/800 over WBD), LUBROLENE WFR provided technical, economical & environmental benefits. But due to small amount of spray, mists of WFR had a difficulty to reach all surface areas in the case of complicated cavity. This difficulty was overcome by developments of "Electrostatic Charged spray gun" for die-casting use and "an innovative WFR agent for Electrostatic sprays" so called LUBROLENE WFR-EC. With this innovative WFR-EC which has unique features for productivity, economics, and environment, we aim to change the die casting world. However, by simply changing die lubricant not everything goes well, we believe it is necessary for us to work together with die casters for our big leap forward.

CONCLUSION

The study conducted background investigations of the die casting industry and aluminium melting process, while addressing environmental issues and the capital investment in the industry and process. This report carried out a literature review of energy methodology, comparison of energy and energy methods and applications of energy theory. The environmental friendly regenerative burner system improves efficiency, lowers NOx emission, achieves fuel saving and provides quick financial payback.

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