

Optimization of waste management in plastic & manufacturing industries-The perspective in SME's

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Abstract - Following the onset of industrialization, the buildup of waste is a major concern in many SMEs. The industry has to face many challenges to stay in the market such as maintaining product quality, reducing the production time followed by cost, maximizing productivity, etc. So the waste needs to be properly disposed and taken care of before it affects the reputation of the organization. Awareness and education in the area of waste and waste management is important from a global perspective of resource management. Optimization of waste consists of all the actions and activities which are required to manage waste from its first stage to final disposal. The project is to optimize the waste in small and medium enterprises using various techniques and methods which we are applying by finding various areas of wastes where actual waste occur, that are unaware to the industries although these methods can be used in all the SME's where same type of problems occur. These methods will help the SME's to increase the productivity, profit and quality by effective amount of use of resources

Keywords— Waste, Industrial Waste management, SME's, Optimization

1. INTRODUCTION

One of the crucial problems in industrial sectors is waste. Industrial waste is the waste generated by industries that consists of any material which becomes of no use while manufacturing processes such as that of mills, factories, industries and machining operations. Industrial waste is the reason which causes decrease in the profit, productivity, and efficiency in industry. Industrial waste management is not only limited to solid waste management but also includes removal of factors that affect the formation of waste. Optimization of waste consists of all the actions activities which are required to manage waste from its first step to final disposal. Waste management in SMEs is carefully constructed and environmentally conscious plan to dispose solid and wet waste. Various works in the field of industrial waste management are explained further. Ahmad K. Jassim [1] mainly focused on recycling of polyethylene waste material generated from human activities such as crates or food packages for producing

plastic cement. The conclusion was that the density of produced plastic cement differed which was totally dependent on the percentage of polyethylene waste in the concrete mix design. Johnson Kwabena Appiah, Victor Nana Berko-Boateng and Trinity Ama Tagbor [2] focused on solving problems in Ghana which were the management of municipal plastic waste and the formation of potholes on roads. The solution to this is the use of plastic waste materials for road construction. Alan Hughes, Sotoru Ogura, Pryor, Allsion and Williams [3] have found a method to reduce mold change downtime in injection molding machine by electrically and fluidly heating the dies before inserting into the machine for preparing the dies to make parts more quickly. Khalaf Y. Al-Zyoud [4] invented a new method of insulation wire for power transformers where he replaced and experimented glass fiber coating with electric insulating craft paper. Meng Shiun Wei [5] has conducted study on reusing and recycling of industrial wastes in Taiwan. Camille Jourdain [6] has focused on non-hazardous wastes coming from collection sites in France. The aim is to increase the quality and quantity of reusable materials. Mohd. Anas and Pramod Kumar [7] have conducted a case study in Scooters India Limited in which he has used the method of ABC Analysis. Qi Wang and Fenglian Fu [8] have used ion-exchange processes to remove metals from wastewater. Mr. Mahadeo A. Chougule and Shrikant Kallurkar [9] have given applications of value engineering for reduction of costs of furniture product. Yogesh B. Patil [10] used gold cyaniding integrated biosorption-biodetoxification technologies. He used rice husk as biosorbents which was very efficient. He concluded that rice husk has maximum capacity for gold cyanide sorption in comparison with Eichornia root biomass.

The main aim of the project is to optimize the waste in small and medium enterprises using various techniques and methods that are unaware to the industries. During this research we have studied different areas of wastes and factors that are responsible for formation of waste, so we can reduce or optimize them using certain number of available methods and

techniques. Overall methodology of optimization of waste management in industries shown in fig.1.

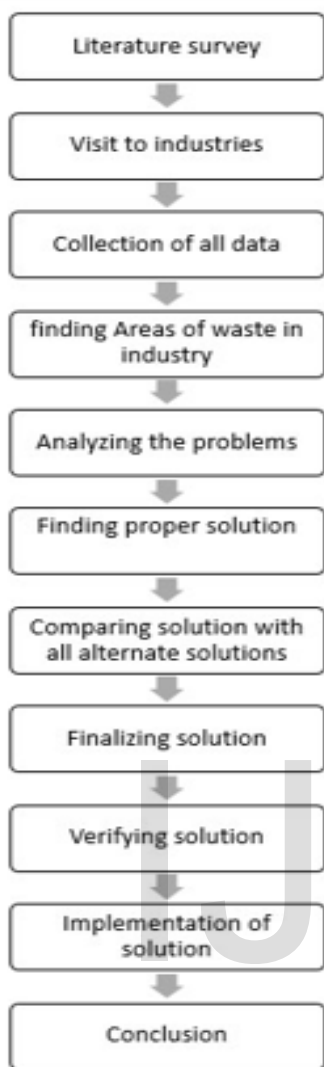


Fig.1. Overall methodology of optimization

2. DATA COLLECTION

Archana industry is well known for its production of various plastic products. We have observed various molding processes and variety of dies which are used for production of various products and we found some areas of wastes where optimization can occur such as 1. Currently the company is recycling plastic after first cycle of production. But after 3-4 cycles of production the quality of recycled plastic decreases which is not used for further application. 2. The die used for various products is different. So it takes time to change and pre heat the die for mold preparation. Following data was observed.

Types of manufactured products	Laboratory dishes, Plastic bottles, Plastic toys etc.
Raw material required per day	200kg
Raw material cost per Kg	70-250 per kg (depends upon quality and grade of plastic)
Time taken per unit	Plastic toys- 30 to 40 Sec for each unit. Laboratory dishes- 1 to 1.5min per unit (As more precision is required)
No of machines	5 Injection molding machine, 1 Grinding machine
Time required to change dies	10-11 minutes
Temp of Mould	29 to 85 C
Temperature of molten plastic	218 to 270 C
Waste per 100 kg	2-3 kg
Total waste generated per day	4-6kg
Current optimization Technique	Recycling
Total production per day	180-185kg
Total production cost	34000 Rs.

Standard Wires is a company which is well known for wire production. There we observed their manufacturing processes – how the wires were moved and how using wire Drawing process reduction of diameters take place from one machine to another after completion of process and how lapping of copper wires take place using electric Kraft paper. The areas of waste where optimization of waste can occur were.

Parameters	Data
Type of industry	Service and production based industry
Manufacturing of products	Copper wire with coating of insulating Kraft wire
Raw material	Copper wire and electric Kraft paper
Total cost of raw material	Copper wire costs 464Rs. per kg & Cost of electric grade insulating paper is 160Rs. Per kg
Time taken	2-3 hours to complete one bobbin of 40kg of 3 mm diameter.
Thickness	0.3 microns for small diameters. 0.4 to 0.5 microns for large diameters wires according to customer demand.
Number of machines	4 units of lapping machine, 2 Wire drawing machine
Total waste generated per day	2kg
Total Production per day	230kg
Total cost of Production per day	108800

Parameters	Data
Type of industry	Production Industry

3. METHOD AND CALCULATIONS

The methods such as value analysis and reusing are focuses on reduction of cost and optimization of Waste. Value analysis known as tool for cost reduction, in reduces unnecessary costs, hidden costs which can be obtained by elimination of processes of modification of processes. Although reuse is waste management technique which is currently is being used in many of industrial sectors, whereas in technique of reusing waste material is used in different processes by considering the aim of total optimization. We have used technique of value analysis and reuse in both of the industries. In Standard Wires we have used technique of value analysis in which we have tried to modify overlap process of cooper wires using Electric grade insulating Kraft paper. By using this technique we have tried to reduce overlap percentage of electric Kraft paper from 50% to 35%.

In Standard Wires at first place we have checked some factors such as current usage of Kraft paper per meter of copper and current usage Kraft paper at current percentage of overlap. Following calculations are done. Length of paper required to lap copper wire having diameter of 2mm-

Sr no	Length of paper	Length of copper wire
1	13mm	10mm
2	195mm	150mm
3	1300mm	1000mm

Different Percentage of overlaps with different amount of required wire per meter of copper wire.

Overlap percentage	Required paper	Required paper per m	Thickness of paper in μm
50 %	2.5mm	2500mm	65
45 %	2.2mm	2200mm	65
35 %	2mm	2000mm	65

By changing overlap percentage from 50% to 35% of Kraft paper we can save 500 mm of Kraft paper per meter of copper wire with a nominal thickness of 65 micron.

In Archana industry at first place we have studied there current waste optimization techniques and waste management methods by analysing these we have suggested them method of reuse of plastic polyethylene waste with a Portland sand in a cement making. Such type of research was conducted by Ahmed k Jassim [1], where he used polyethylene waste to produce plastic cement in Ghana. According to research Portland cement can be mixed with fine polyethylene waste and water using different percentage of wastes. According to research and experiments he found that the best and suitable percentage of waste polyethylene is 25 to 35% as density of cement is high for such percentage of polyethylene which give good properties of mixturemilling, based on this research we have provided following calculations and method of Reuse of plastic to the industry

Experiment no	HDPE %	Portland cement %	Water %	Density gm/cm)
1	15	85	25	1.458
2	25	75	25	1.660
3	30	70	25	1.927

4	60	40	25	1.35
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4. RESULT AND CONCLUSION

The various techniques and methods are used for effective optimization of waste in SME.s. In certain plastic industries by technique of reusing we can save some percent's of plastic wastes which occurs from daily production with the technique of reusing we can some amount of die changing time by process of preheating, Although in some of wire industries we have saved usage of extra electric insulating Kraft paper just by changing overlapping percentage of paper from 50% to 35% with a saving of 500mm of paper per meter of copper, it leads to saving 250m of Kraft paper just in a single day as well as it makes good contribution for reduction of total production cost.

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