

CLEANER PRODUCTION, A SUSTAINABLE STRATEGY FOR THE SMALL SCALE INDUSTRIES-A LITERATURE REVIEW

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Abstract: It has been observed since nineties that along with rapid industrialization the irreparable environmental degradation is followed. The objective of this paper is to enlighten a cleaner production approach for environmental, economic & technical advantages for small scale industries. Basically pulp and paper, rice manufacturing, chemical and food industry has been taken in to account. Practice of good housekeeping with process or technology change improves the efficiency of the production environmentally. Despite technological progress, improved human resources and development of progressive policies, global production and consumption patterns generally remain unsustainable. It is a complex task to give common CP solutions for all the small scale industries because of their heterogeneous nature, so here the individual study has been done on various industries in order to derive CP strategy. This paper suggests phase wise minor modifications in process results in a great waste minimization which lessens the end of pipe treatment. As a result more than 50% BOD & COD reduction in food industry, by product recovery in rice manufacturing industry and efficiency improvement in Pulp and Paper industry could be gained. Byproduct recovery and to reduce the raw material consumption are the secondary goals of cleaner production. It is the mean by which the sustainable development is governed.

Key words: Waste minimization, cleaner production, by product recovery, sustainable development, end of pipe treatment.

1. INTRODUCTION

Cleaner Production is not a new concept. It is a logical extension of the desire to conserve the raw materials: the natural resources and reduce waste at source. It requires to examine ways that result in increased productivity, reduced resource exploitation and waste generation. Energy is an important input to industry along with the resources and it provides considerable scope for cutting costs for the industries. It is estimated, based on successful demonstration projects, that savings of 20-25 percent are achievable with existing equipment and other 30-60 percent could be saved if investments are made in new, more efficient equipment. Cleaner production is recognized as an effective way of addressing material and energy resource productivity. If the link with creation of waste is identified, now that waste could be utilized as a

resource in the same industry. Which may reduce the cost for both –buying raw material and handling the waste generated.

Energy is the other necessary parameter which is being used abundantly in the industries for the manufacturing purpose but the approach towards efficient energy consumption is not applied effectively. Though it will reduce the cost after a certain time period, it requires high capital cost in beginning for installation of new machinery which is energy efficient.

environmental preservation, economic growth and sustainable development are to be achieved by the CP approach application, energy efficiency (EE) must be an integral part of a total system strategy of CP. preventive environmental strategy, is the ideal framework in which to incorporate such an approach. CP and EE are two complementary avenues, which, if combined, offer synergistic benefits that will lead to both environmental and economic progress.

Generally there are for possible options available to respond the pollutants. One is to ignore, other is to dilute and let them disperse, third one is end of pipe treatment, last and the most effective way is cleaner production.

2. SCOPE OF CLEANER DEVELOPMENT AND GENERAL IMPLICATIONS FOR SMALL SCALE INDUSTRIES.

There may be various possible reasons for the industry to reduce the pollution or to treat the waste. It may be for dealing with the regulations or for the sake of the reputation of the company. It may be to reduce the waste or to prevent the waste generation. Cleaner production deal with the last purpose: prevention of waste generation.

In the pulp and paper industries are still using old technology for pulping. It uses elemental chlorine for the bleaching of pulp which results in high extent AOX generation. Consumption of the fresh water is very high and simultaneously it leads to higher volumes of wastewater generation. It produces solid as well as odorous gaseous emission stream from various sections.

On contrary rice manufacturing industry produces very less quantity of liquid waste whereas solid waste, gaseous emissions, noise and vibrations are of major concern which requires the modification in the strategy.

In food industries vast amount of organic matters present in the effluent produces a high level of turbidity. It leads to exemption in the values of BOD and COD which is of major concern. Chemical industries are mostly concerned with the emergence of hazardous and toxic wastes from their production houses. The uncontrolled dumping of highly contaminated hazardous wastes without passing them from considerable treatment could lead to the growing number of formerly unknown diseases and risks to the human. Cleaner production approach for the same has been studied and suggested for these industries running on small scale.

3. METHODOLOGY

There is no single method for waste minimizing which can be applied for all the industries due to their heterogeneous nature of products as well as the waste. So specific measures must

be provided to the particular industry for applying cleaner production on small bases. A general methodology which could be applied to all the small-scale industries are

- (1) Planning and organizing the natural resources being used in manufacturing section;
- (2) Analyzing the research potential to identify the waste generated at their source and its characteristics;
- (3) Proposing the possible solutions and methods available to reduce the waste, pollution and emissions;
- (4) Examining the feasibility and cost effectiveness of all the possible solutions;
- (5) Implementing the most appropriate solutions.

However, cleaner production is not a one-time-project. In order to achieve the sustainable development and long-term benefits, the industry requires a system of CP strategy to maintain and improve.

3.1 pulp and paper industry

In general, the status of the cleaner production in the pulp and paper industry is highly recommended . India has more than 700 paper industries which consumes drastic amount of water for their manufacturing process. Wastewater is generated from washing of wood chips and rice/ wheat before pulping. Chemically contaminated wastewater is been generated from the washing of chemically cooked pulp and during pulp bleaching, also while cleaning the pulp containers. Filtration for wire section of paper machine and paper machine presses also contribute to the wastewater stream. As a cleaner development option recycling the water from barking section will result in great reduction to wastewater generation. Instead of wet debarking dry debarking should be implemented. Use of efficient process and machinery which reduces the probability of failure and thus minimize the non routine wastewater and black liquor. Bleaching requirement should be minimized. To aim for Zero discharge where ever in the industry it is possible.

Along with the liquid waste solid waste generation from various sectors of industry is also considerable. They are produced by raw material handling, rejects from screening, sludge generated out of wastewater treatment, coal or boiler ash from the power generation section and lime used for the chemical recovery. As a CP solution recycle and reuse of additional solids generated should be applied with simultaneous process of operators training and motivation to reduce waste generation at source.

Air pollution regarding pulp and paper industry is due to odorous gaseous emissions such as hydrogen sulfide, methylmercaptan, PM, SO₂, NO_x. The major sources for these emissions are gases from digesters, gases from MEE and emissions from recovery. Process or equipment modification is a green solution along with fitting and maintenance of appropriate APCs.

3.2 Rice Industry.

The study indicates that rice manufacturing industry is the characteristics of energy consumption and several types of wastes are being generated out of it. Energy is drastically being used in machinery. Charcoal is being used in the dryer. As a major concern, rice manufacturing industry emits the major green house pollutant: CO₂. Along with the gaseous emission husk and rice bran are generated as byproducts, which is generally 20% of the main product paddy generated. It contributes to the solid waste. Noise and vibrations are also being

generated during operation of the machinery but these streams are generally not given priority.

For dealing with the energy issue, the small scale industry should manage the energy efficient process and must use the energy saving machinery. Effective energy management system (EMS) along with the workers keen interest towards energy saving will lead to good results in terms of energy efficiency (EE). Rice manufacturing industries are less concerned with the liquid waste. It generates lesser volume of contaminated water so there is no issue of handling it. For rice industry solid waste is a major concern for that as a cleaner production solution on-site recovery solution of rice husk could be done by producing useful and more valuable by-product – Rice husk charcoal.

3.3 food industry

For food industries major source of waste identified is a liquid waste: the wastewater from the various sources in the industry. COD and BODs are of a great concern in case of food industries as they contain maximum amount of organic matter present. Because mostly these industries uses agro based materials as their raw material the effluent generated from such streams are rich in organic content. The organic matter gets decomposed by the microorganisms and that would cause the generation of excessive COD and BOD in the wastewater generated. With this the another reason which also affects the generation of high strength effluent stream is inability or unwillingness of workers to put their efforts for waste reduction it may be due to the lack of awareness among the workers or due to lack of proper motivating CP strategy. Workers are less thorough in taking the scrap from the machines and production tools before they are being washed. These scraps would get dissolve in the wastewater steam when it is washed without pre-scraping and may lead to high BOD content. Directly soaking or washing the equipment would lead to more dissolved solids and thus a high turbidity as an indicator of high organic content in the wastewater stream. From the study it has been noted that housekeeping alternatives based on the cause analysis of waste generation at source, the alternatives proposed are: (1) improving the worker thoroughness in the manufacturing operation and (2) cleaning the scrap on the production tools before washing them off. The feasibility of the implementation of these alternatives has been evaluated from the economic, technical, and environmental aspects.

3.4 Chemical industry

Drugs & Pharmaceuticals, Fine chemicals, Dyes and Dye Intermediate, paints, Basic Inorganic and organic chemicals, pesticides and Insecticides, Fertilizer are the major chemical industries in India. These are the oldest industries and still they are growing at a faster rate. Specially in case of chemical industries it has been observed that there lies a gap between the research and the development. Because of which chemical industries in India are utilizing more power consuming machineries in the production process. Along with that hazardous and toxic waste is being generated from these industries.

4. CONCLUDING REMARKS

From the study it has been found that in all these three industries there is a high potential for waste minimization and increased efficiency of production with the same finance and resource exploitation. The issues related to the energy consumption have not surfaced considerably and this means that there holds a great potential in that area. The faster benefits

achieved out of implementation of any CP measures would give a good incentives to the industry management sector and it will sustain the interest of the workers to implement the CP approach. As the efforts towards the implementation of the cleaner production technologies are concerned, they must be taken on a regular basis. This can be achieved by way of employing different measures towards generating and maintaining a good database of the implemented cleaner production technologies or measures.

Small scale industries are sparing more money on waste handling, treatment and disposal against which their capital should be invested in process modification or change which will lead to a drastic waste reduction.

In case of small scale industries along with process change, minor design change in the manufacturing equipments or the EMS's equipments.

Along with the major changes small efforts like good housekeeping, reduced energy consumption, reduced raw material consumption, reuse and recycle concept for valuable waste generated, waste to energy concept, recovery of costly metals and by product recovery. This can be achieved by stringent regulations and its strict application.

REFERENCES

- [01] Tran Quoc Cong*, Do Ngoc Hien, Feasibility of cleaner production for Vietnam rice processing industry, journal of irp, 13th Global Conference on Sustainable Manufacturing - Decoupling Growth from Resource Use, Procedia CIRP 40 (2016) 285 – 288
- [02] Jos Frijns, Bas Van Vliet, Small-Scale Industry and Cleaner Production Strategies, World Development Vol. 27, No. 6, pp. 967-983, 1999
- [03] C. Visvanathan*, Mahesh Patankar, and niclas svenningsen, promotion of cleaner production in the pulp and paper industry: a technology fact sheets approach. Environmental Engineering Program, Asian Institute of Technology, Bangkok, Thailand, United Nations Environmental Program, ROAP, Bangkok, Thailand.
- [04] Nafis Khuriyati*, Wagiman, Denok Kumalasari, Cleaner Production Strategy for Improving Environmental Performance of Small Scale Cracker Industry, Agriculture and Agricultural Science Procedia 3 (2015) 102 – 107