

# Environmentally Benign Manufacturing

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**Abstract:-** Today in the era of rapid industrialization with abrupt increase in global population and innovations in technology, it becomes very important to maintain the balance between the development in manufacturing processes and environmental protection. "Environmentally benign manufacturing" is the new systematic approach that reconsiders the manufacturing methods for environmental protection. The environmentally benign manufacturing is similar to the sustainable manufacturing in which we prefer the manufacturing of goods through economically sound manufacturing methods and will produce less negative impacts on the environment. As we know India is acting as an emerging market in this rapid development era but still it is contributing the most amount of pollution at global level. Environmentally benign manufacturing is being implemented in Japan, Europe and Russia even in small-scale productions. In this paper, we reviewed that how Japan and other developed countries have introduced EBM in manufacturing methods and how the traditional manufacturing methods in India can meet criterion for environmentally benign manufacturing.

**Key words:** Environmentally Benign Manufacturing, Sustainable Manufacturing, Secondary Manufacturing, Particulate Emissions, Reduce Reuse Recycle (3'Rs).

## 1. INTRODUCTION:

Technological advancements in modern era made us capable of manufacturing goods at peak level. We successfully tackled the obstacle of shortage of goods in various fields through mass production but mass manufacturing of different products has actually contributed to the mass pollution or release of maximum amount of solid waste into the surrounding. This solid waste must be either disposed or utilized in the second cycle of manufacturing in the same field or in the different category.

Various industries like cement, fertilizer, pesticides and mining industries has contributed the maximum amount of pollution since last few decades. Due to ever increasing demand of cement and concrete industries since last few decades they alone account for 5% of greenhouse gases so control on its pollution through some few changes in manufacturing process of cement and concrete is very necessary. Mining industries are capable of producing widespread and long lasting effects on environment and traditional methods of controlling those effects are more focused on controlling after its release into the surrounding and not before its discharge into the environment.

While manufacturing articles of metals like aluminium, copper and brass chips are generated which is considered as a scrap. It becomes very difficult to recycle the scrap generated through manufacturing methods by conventional methods. Therefore, there is need of more economic and eco-friendly method recycling the scrap without melting them as it costs a lot, which would be equivalent to manufacturing cost of product from which the scrap is generated.

Water requirement has abruptly increased since last few decades both in industrial and urban area due to innovative development but only 15-20 % of water is used for human consumption and rest 80-85% is used for industrial development this actually affected the natural water resources in negative way. Lacks of investments has done for purification of water bodies and it got succeeded but the capital cost of production system risen a lot.

Every manufacturing process should end up with minimum waste and minimum negative impact on environment. In order to achieve it raw materials should be passing through multiple cycles of manufacturing processes so that every cycle will generate the useful product and at the end with minimum damage to the environment.

## 2. LITERATURE SURVEY:

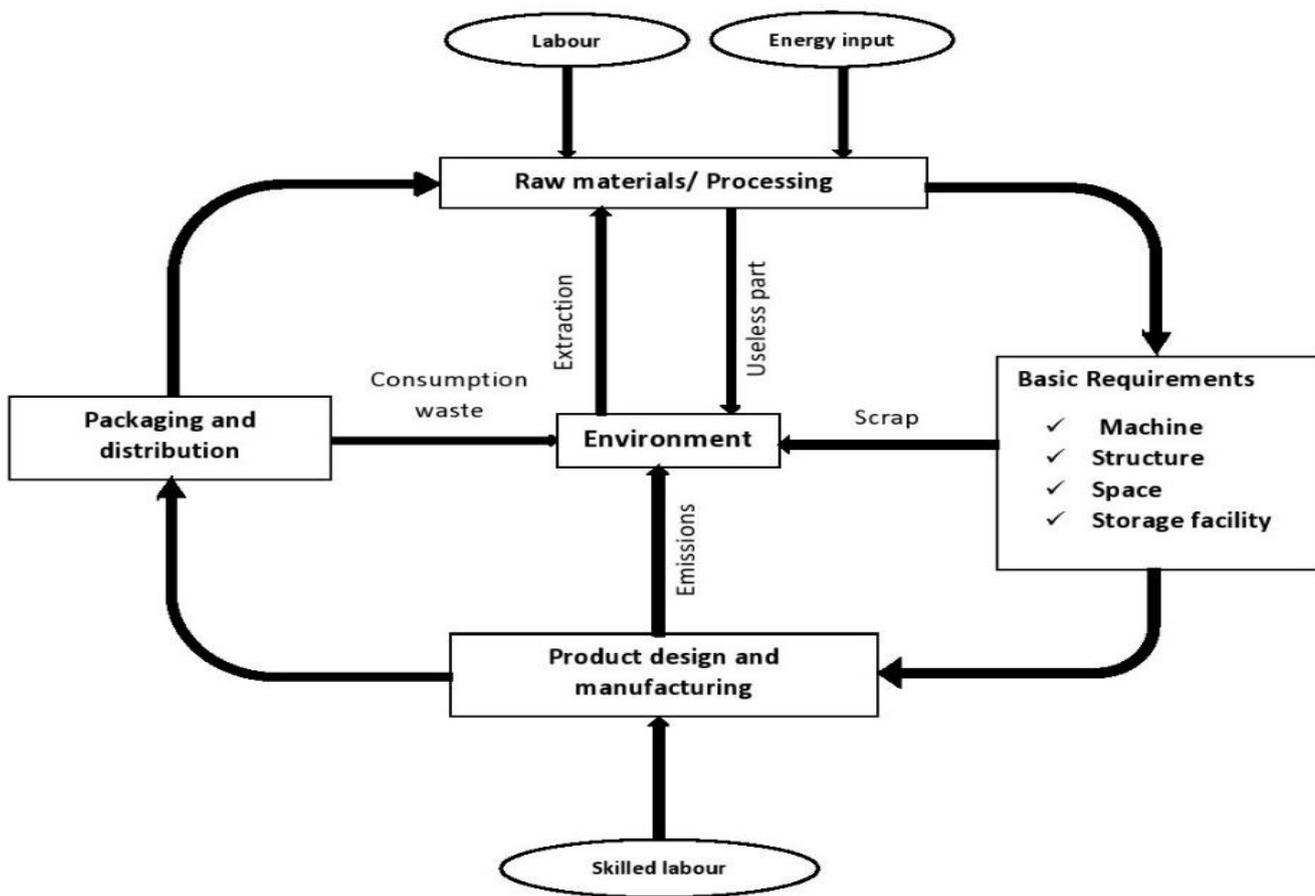
In the current era the cement and concrete industries have greater demand in market and they are capable of producing higher volume of cement compared to past. The particulate emission in cement industry can be controlled by passing the raw material through the kiln and dust can be removed by electrostatic precipitator, wet scrubber, or by ordinary bag house method [1].

During benefaction of soil in mining sites to obtain the required metal different chemicals are used which result in damage to the soil and animals living around the mining region. During early days biological oxidation method was preferred for protection of animal species but due to increase in particulate emissions the method is no more suitable for protection of animals instead treating the soil with hydrogen peroxide or air detoxification process in preferred [2].

The manufacturing research in the field of environmentally benign manufacturing requires to study the interrelation between the environmental impact and energy consumption and evaluation of economic considerations. The analysis at global level about the environmentally benign manufacturing must be accompanied at the local level by considering its impact on local environment and local resources [3].

Rise in generation of solid plastic waste already affecting the both developed and developing countries in worst way. Approximately 50% of total manufactured plastic is used as the single use product and afterwards it is considered as the waste. Most nations implemented the general strategies like the land fill bans, Deposit repay systems and extended producer responsibility (EPR) [4].

### 3. GENERAL MANUFACTURING CYCLE

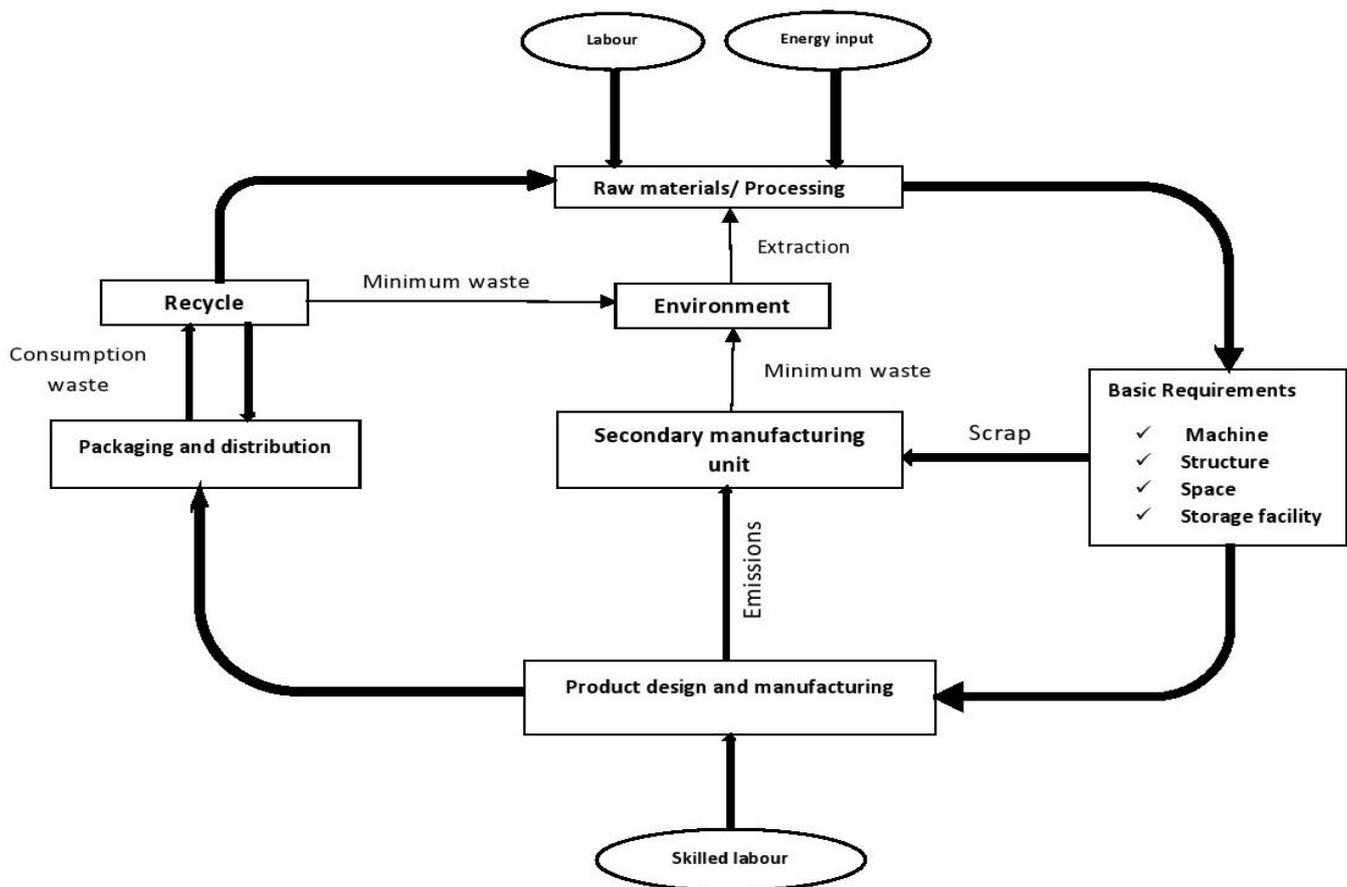


Generally every manufacturing cycle starts with the raw materials which forms the primary need of the manufacturing. The manufacturing cycle processes the raw materials in order to convert the raw inventory into work In progress inventory. During this processing the non-useful part in again extracted into surrounding. Every manufacturing cycle has some basic requirements that mainly includes the machine tools, adequate space, workforce and appropriate inventory facility based on the type of raw material. During general manufacturing process, the manufacturing of this basic requirements result in generation of lot of scrap or waste materials which again extracted into the environment. Through machine tools and structures the actual product is manufactured with use of skilled labour and emissions are again extracted into the surrounding along with sufficient amount of scrap. The finished product is further passed to the

packaging and its proper distribution is ensured. Again packaging and distribution of final product result in generation of consumption waste which directly gets added into the environment.

Right from the beginning of general manufacturing cycle till the supply of final product to the consumer lot of scrap, waste and emissions are added into the surrounding which results in pollution at vigorous scale. In order to nullify this drawback the general manufacturing cycle is replaced with the environmentally benign manufacturing which is eco-friendly and cost effective.

#### 4. ENVIRONMENTALLY BENIGN MANUFACTURING CYCLE



Environmentally benign manufacturing is entirely similar to the general manufacturing system but only difference is it has provision for minimizing the amount of scrap and emission directly into the surrounding. In order to minimize this the scrap or waste materials are made to pass through the secondary manufacturing cycle and for controlling harmful emissions into the surrounding the manufacturing cycle is provided with few pollution control methods. Since this method has extra provision for eco-friendly and cost effective manufacturing it is called as environmentally benign manufacturing. As per the current scenario the manufacturing industries like fertilizer and pesticides industry, cement and concrete industry and mining industry has major demand in market and is fulfilling this demand successfully but this few industries actually contribute to the maximum amount of particulate emission. In addition, the steel and aluminium industry is running at peak in India and they need the provision for secondary manufacturing of scrap. The environmentally benign manufacturing also has provision for recycling and reusing of consumption waste.

**So main significance of environmentally manufacturing is:**

- A. Secondary manufacturing for scrap
- B. Pollution control for particulate emissions
- C. Recycling and reuse of consumption waste

### A) Secondary manufacturing of scrap:

In modern production system the manufacturing of steel is done either in the blast furnaces or the electric arc furnaces. The steel production in blast furnaces is based on the use iron ore and little amount of scrap as an additional element which serves as a catalyst while the another method which is the electric arc method which is totally based on the use of scrap as a raw material this considerably reduces the environmental footprint of steel production.

The scrap aluminium can also be used in the products after its starting phase of production. Secondary scrap manufacturing of aluminium has boosted the theme of sustainable manufacturing in current time at global level. The increased use of recycled aluminium significantly assisted the aluminium suppliers to build their resources in developed countries.

Consumers are getting more attracted to the Industries, which implement the sustainable manufacturing and have good environmental record of accomplishment. The big industries like Apple generate 66% of their aluminium requirement through recycled aluminium and they are aiming at 70%. Generally, manufacturing of aluminium requires its extraction from its bauxite ore, which requires lot of energy while manufacturing of aluminium right from its scrap requires only 5% of energy of its traditional process. It only involves the remelting the metal which is far less expensive.

### B) Pollution control for particulate emission:

In cement industry it would be better to control the particulate emission at the sources rather than in the actual system. The best method to control the dust amount is passing through the kiln creating the clinker. The clinker serves the function of the binder which helps in disposal of dust.

Many chemicals are used for leaching and dressing of soil at mine sites. For example in case of gold and silver manufacturing cyanide is the element which toxic in nature is used for extracting gold and silver. The silver and gold melts in cyanide which can be regenerated but this process causes the widespread ecological damage to the diaspora. But this cyanide infection to the animal species can be controlled by treating it with hydrogen peroxide or the very slow process like biological oxidation.

### C) Recycling and reuse of consumption waste:

The recycling of metals like aluminium consumption waste results in significant cost saving even if compared with manufacturing of new aluminium metal even if cost of collecting scrap aluminium and its shipping charges are considered.

Technological advancements has diminished the gap between first use plastic and recycled plastic. Innovative technology aims at the increasing the value of recycled plastic in order to make it capable to be used in as many applications as possible. One of the way to increase the value of recycled plastic through technology is to convert the recycled plastic into the food grade polymer by removing all the contaminants and pollutants. By various social, economic, and market strategies it is possible to implement the various techniques to improve the quality of recycled plastic.

The recycling of consumption waste can be beneficial to the surrounding in following ways:

- 1) Saving in energy and raw materials.
- 2) Reduction in air and water pollution.
- 3) Reduction in use of water and other natural resources.
- 4) Reduction in generation of toxic materials from mining

## 5. CONCLUSION

Environmentally benign manufacturing can be implemented even in the small-scale production system for preserving resources and environment. Pollution control of particulate matter and recycling of scrap along with protecting the environment also save the energy and are cost effective. Environmentally benign manufacturing is the need of current world as the effect of increased pollution and solid waste already affected the human beings and if not taken into account can affect in worse manner. Plastic waste management and its recycling is the most important concern in the current world as almost 50% of the total manufactured plastic is considered as the consumption waste and all are the one use products. Cement and concrete industry in the prominent respondent for the 5% emission of total greenhouse gases and it can be controlled.

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## 7. BIOGRAPHIES



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