



## RECYCLING PLASTIC WASTE AND METHODS TO REUSE THE RESIDUE USING REFINE MACHINERY SYSTEM DESIGN

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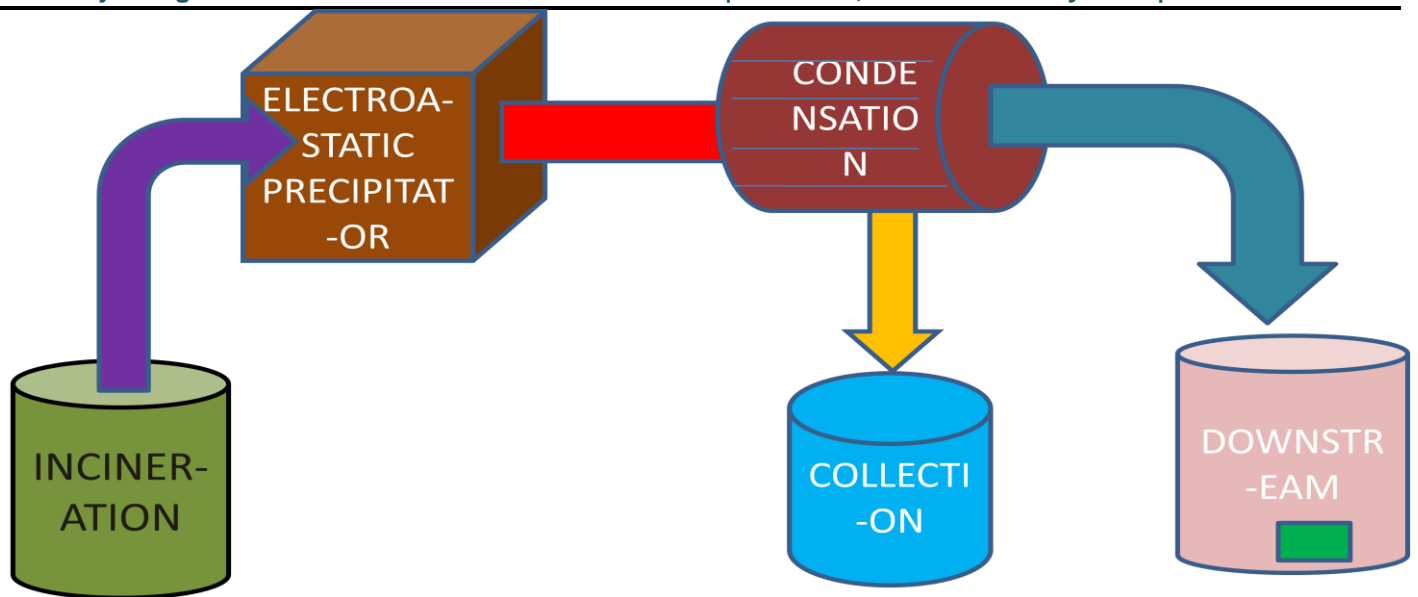
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**Abstract:** The machinery design invention consists of several stages that refine the waste plastic and make it reusable for the mankind. The initial section of the design is the incinerator that burn the waste and deduct the amount of waste into small ball shaped material will be liquefied for further refinement. Then harmful gases treatment chamber is followed i.e. electrostatic precipitator that somehow purify the air quality and make the air free from unburnt particles. The condensation chamber effect the air with its cool temperature and a steam will be formed that will be collected into a separate vessel for further processing. After the remaining air will be sent to the downstream chamber where silica gel beads will absorb the remaining harmful gases and the plastic will be recycled without any harm to the environment.

**Index Terms -** Waste management, Pollution, Incineration, Purification, Air quality index.

### I. INTRODUCTION

We share this universe with all the other living and non- living beings that makes our biota. Our environment was very neat and clean earlier but after the industrialization and many revolutions (Blue revolution, White revolution etc.) became polluted. (M.E.Conti and G. Cecchrtti, 2001)It was observed that the photosynthetic pathway was disturbed as the level of Sulphur-di-oxide in the atmosphere was increasing day by day. Actually lichens are the natural indicators to detect air pollution and air quality index because as the structural changes occurs inside them that disturbs their natural cycle. Then, the era of polythene came into market. Polythene was best invention throughout the history. It made everything easy to carry, light weight thing, especially to distribute milk etc. (Rodriguez, 1990) Everything was fine but the waste generated in factories and the use and throw policy of polythene created a difficult situation to handle. Tons of plastic is collected every week from every small town to a big city. In India the consumption of plastic has increased from 400 Ton /year in 1992 to 5 Metric Ton /year in 2005 and above 25 million tons in 2020. In fact Delhi holds an international status to collect huge amount of plastic every day. A proper management is required to control this machinery system can be used to recycle plastic and reuse the waste to reduce the amount of non-biodegradable waste. The whole system is a design that enables the process to recycle the plastic without harming the environment. Waste is of two types the first one is biodegradable and the second one is non-biodegradable. Municipality Corporation collects waste from colonies and categorizes into biodegradable and non-biodegradable waste and forward that for further disposal process. (Pushpakalambiga & Jasmine, 2019) Biodegradable waste is easy to handle as it can be used in vermin composting, manure (Gade Vankatesham and K.S.S.S.N. Reddy) and can be used in paper industries and if they are digged into fields then that will increase fertility of soil. But when it comes for non-biodegradable waste, we fail to manage. There are only two methods to dispose plastic i.e. either to bury into lands or to incinerate. (Rohit kumar singh & Biswajit Ruj, 2016) Both of these methods are not suitable. Upon burying the chances of landslide are there due to reduction in soil holding capacity of that area and it's the only reason that many buildings are falling down after construction because they were made upon the burial lands. The process of incineration is also directly effecting environment like disturbing natural cycles, contributing to raise CO<sub>2</sub>, CO and unburnt particle level in atmosphere that directly increasing global warming. (Sivaramanan, 2015)To solve the above problems the design is made (refer to Figure-1) it contains four chambers 1) Incineration chamber, 2) Electrostatic precipitator, 3) Condensation chamber, 4) Collection of waste, 5) Downstream.



**Figure 1-** Showing design of machine with all the sections

## II. METHODOLOGY

The procedure was completely based on an experimental work, where we gathered a bunch of waste polythene bags and plastic, weighed them, the approximate weight was 1 Kilogram and then it was sub divided and made into small sized balls that were easily administered inside the (Incinerator) machine system then the plastic was burnt and huge amount of black smoke was produced. After this the fumes went upward for the air purification section (Electrostatic precipitator), where the unburnt particles were separated on the general principle of precipitator. After that the partially cleaned air was supplied to the third chamber (Condenser), where the hot air was encountered with a cool atmosphere and the steam was formed which was collected in a separate vessel (black slurry). At the last step (Downstream) the remaining air quality was improved upon the application of silica gel beads (0.8 mm) the other harmful gases were adsorbed. Hence the temperature was 150°C in the first chamber so the material was made up of an alloy of (Fe + Cu) that will allow withstanding the system at high temperature as the high melting point property.

### 1) Residue utilization upon mixing charcoal-

The slurry in the container was extracted and mixed with the residue left in the first chamber. Then after some heat treatment scrap was isolated and mixed with charcoal (resin). Then, the molten plastic liquid was poured into a casting tray. After some time a shape was taken by the poured liquid into sheet.

### 2) Residue utilization upon mixing Di calcium silicate-

The black slurry was mixed well with Di calcium silicate and left for casting of a brick.

## III. RESULTS

The result was more than the expectations the amount of brick produced was a quality tested brick that can be used to make houses for poor families and as the water repellent property of plastic is there it will be the best out of waste. Even these bricks can be used to make a temporary house during a natural disaster like Earthquake. Along with the sheet we formed can be used as temporary shelter at that time. Every city gathers tons of plastic at the end of the every week and it would be the best way to utilize the entire waste without harming nature. Municipality Corporation can open a separate office at outskirts of every city for this entire process. If this strategy will be followed then our air quality index will improve by 75% by 2025. All natural cycle will come to normal stage and the global warming will be controlled. Beside this the ozone layer depletion will also be managed as this entire process is eco friendly

#### IV. DISCUSSIONS

The entire process was eco friendly where each and every step was performed with the concern to environment issues. No ethical issues were raised in the experimental analysis. The key point of the entire setup is to make our environment neat and clean. It should be free from all types of pollution. Following the steps we can control global warming, increasing CO<sub>2</sub> level and many more things. Air quality index will be less polluted, after using this machinery in each and every local area where the unwanted plastic and other solid waste is thrown by local public everyday and proper motoring is required in this entire process. .

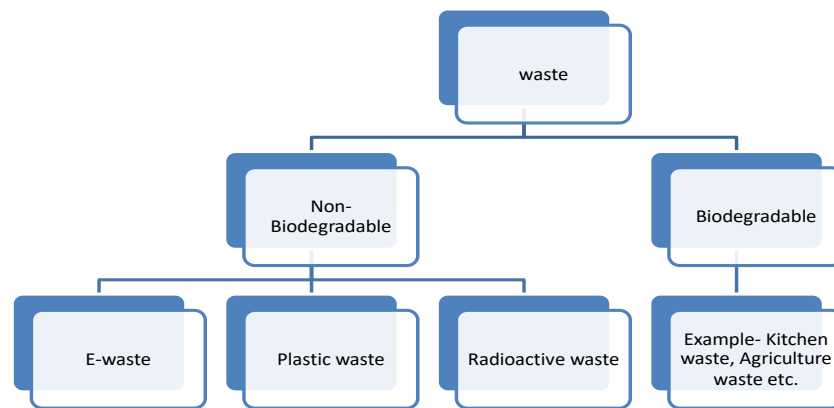


Figure 2- Flow chart showing categorization of waste

#### V. CONCLUSION

The entire invention is design and method to recycle the waste plastic without harming any other community. As mentioned above the machine is sub divided into chambers that have their own role in recycling. The step which must be followed before using machinery is that to separate the plastic material from the mountain of the garbage in outskirts of a city. Plastic are of two types thermoplastics and thermosetting plastics, thermosetting plastic cannot be melted such Bakelite and melamine made up of a very dense resin of phenol formaldehyde and they have cross linkages also that make them very hard, but thermoplastic are made up of low density polymers like poly vinyl chloride (PVC) etc. they can be melted under 150 °C temperature. The scrap should be separated and cleaned as much as possible and then the waste should be converted into small granules to reduce the energy consumption in the incinerator section. Upon utilizing the principles of thermodynamics the heat transfer is controlled using sensors. There will be a proper oxygen transfer valve in the first chamber because it is a closed chamber the burning needs optimum oxygen supply. The next two steps are the part of air purification. The fourth chamber is consists of silica gel beads that absorb the moisture and harmful gases left in the burnt air. In many coal mines the problem of asthma and bronchitis is very common because they are directly exposed to gases. At the end the fresh air is released in the atmosphere with approximately null pollutant composition. The residue in the first chamber and the collected fluid in the condensation chamber is then collected and purified for industrial and public welfare. The conventional method used for this purpose by Municipal Corporation in not advanced as the disadvantages discussed earlier that they bury the plastic waste into land which takes 1000 year to decompose. On the other hand, the incineration procedure they follow is not advance the harmful gaseous content is still remain in the air released at the end of the process. An eco friendly process can be the best solution to overcome many environmental problems.

#### VI. LIMITATIONS AND FUTURE STUDIES

It has limitation on radioactive material management and it's a model for the practical use. The above study case was performed on small scale but if further modifications will be done by professionals. Some special sensors may reduce the labour work. Artificial intelligence should be indulged in future for the best use of the machinery

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