A NOVEL PLASTIC WASTE MANAGEMENT SYSTEM TO CONTROL AIR POLLUTION

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Introduction:

Plastics are synthetic materials produced by chemical reactions. Plastics exist in different forms based on the type of primary processing. It is openly observable that plastics are greatly used in the current scenario particularly in the management of COVID -19 medical disposals that has led to huge land fill further leading to hazardous because toxic chemicals percolate out into the soil, underground water and pollute the water bodies. Burning of plastic waste is also greatly affects the atmosphere and climate changes by steep increase in toxic gas contents [1-5]. The toxic contents that are produced during burning of plastic waste and that are responsible for hazardousness are Carbon Monoxide (CO), Carbon Dioxide (CO_2), Nitrous Oxide (N_2O), Sulphur Dioxide (SO_2) and other bicarbonates [6-7].

Numerous efforts have been done on reducing the toxicity of these gases. Use of catalytic converter is one of the beneficial technique to control air pollution in which CO is converted in to safer CO_2 and N_2O into N_2 [8-9]. The control of air and water pollution is also possible by using activated charcoal which absorbers NO_x, CO and hydrocarbons from toxic air. It also reduces the bad odour from the smoke [10-12]. High Efficiency Particulate Filter (HEPA) is widely utilised application in reducing the toxicity in which heavy particles are filtered efficiently [13-15. Researchers have also recommended the use of lime stone to reduce calcium and bicarbonates in the toxic smoke [16].

An extensive survey on literatures has motivated us to come out with an idea of novel plastic waste management system which incorporates four filters: Catalytic converter, HEPA, Charcoal and Lime stone. A working model has been developed to filter the toxic air of burnt plastic waste more efficiently.

Objectives:

1. Decrease solid waste generation.
2. To establish environment-friendly plastic waste disposal solutions.
3. To reduce air pollution.
4. Remove maximum amount of toxic content after burning

Methodology:

1) Research and literature survey on waste management and controlling air pollution.
2) To develop a system that controls air pollution by systematic management of plastic waste.
3) The system consists of 4 filters:
   a) Catalytic Converter- It helps to reduce hydrocarbons (HC) and carbon monoxide (CO).
   b) Activated Charcoal – It removes SO_2 content and other harmful gases.
   c) HEPA Filter- It is also known as High efficiency particulate air filter.
      -This type of air filter can theoretically remove at least 97.9% of dust,
      Pollen, bacteria and any airborne particles with the size of 0.3 micrometres.
   d) Lime Solution- Lime solution is used to remove acidic gases, particularly sulphur Dioxide (SO_2) and Hydrogen chloride (HCL).
4) To analyse the chemical composition of the filtered air.

   Compare with unfiltered air and providing scope for the developed system.

Conclusion:

A novel model for that can be efficiently utilised for plastic waste management is developed. The working model contains four filters as proposed in the methodology. The level of toxic reduction was tested with the emission measurement system interfaced with computer which is shown in the Figure 1.

Figure 1: A novel plastic waste management with computer interfaced emission testing

The amount of toxic contents is measured in terms of PPM and is tabulated in the Table 1.

Table 1: Comparison of Toxic contents in unfiltered smoke with filtered smoke of proposed system

Toxic Contents	Unfiltered Smoke	Filtered smoke
N_2O	160 PPM	72 PPM
CO	3500 PPM	2100 PPM
CO_2	20000 PPM	13200 PPM
SO_2	325 PPM	178 PPM

It can be observed from the table that there is convincible reduction in the toxic content in terms of PPM in the air. Thus it can be concluded that the developed model is novel and efficient to manage waste management and reduce air pollution. The tests will be continued further to validate the obtained results.

Scope for future work:

The proposed model can be fabricated as a more sophisticated equipment and can be effectively utilised to control waste management and air pollution. Additional filters can be attached to increase the efficiency. Over all the existing system is having a convincible future scope.