



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 4, April 2023

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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# Odour Control Technology- A Review and Proposal for Mangaluru city Dump yard

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**ABSTRACT:** In today's decade solid waste has become a major threat to environment, ecology, and human health. At present the governments across the world are concerned with the short- and long-term effects of the continuously growing wastes all over the globe. These wastes are changing into various forms over the years taking new shapes and creating one of the biggest problems of the modern world- waste management. Poor waste management results in pollution of many kinds such as air, water, Ground water table and soil thus giving rise to many health hazards and discomforts to living beings in the nearby areas. The current paper reviews ideas that can be effectively utilized as a solution to the odour annoyance occurring at Mangaluru city dump yard and surrounding areas.

**KEYWORDS:** odour Control, dump yard, waste management, bio filtration, model

## I. INTRODUCTION

Solid waste management (SWM) has emerged as one of the most massive development challenges in urban India. Numerous studies indicate that the unsafe disposal of waste generates dangerous gases and leachates, due to microbial decomposition, climate conditions, refuse characteristics and land-filling operations. According to the 12th Schedule of the 74th Constitution Amendment Act of 1992, urban local bodies (ULBs) are responsible for keeping cities and towns clean. However, most ULBs lack adequate infrastructure and face various strategic and institutional weaknesses, such as poor institutional capacity, financial constraints, and a lack of political will. While many Indian ULBs do receive government assistance, almost all of them continue to be financially fragile. India has already exhausted all available landfill sites, and the concerned ULBs do not have resources to acquire new land.

According to the "Swachhata Sandesh Newsletter" by the MoHUA, as of January 2020, Karnataka alone generates 10,000 metric tonnes of total waste per day. The area coming under the jurisdiction of Mangalore City Corporation produces an average of 220 TPD of wastes, with a daily collection frequency of 200 TPD. The waste collected has a composition of 60% of organic, 25% of inorganic, 5% of combustible & 10% of recyclable wastes.

One of the least looked into problems at a dump yard is the odour nuisance. This unpleasant odour is produced by numerous gases, some of which are harmful to our health. The odour nuisance has become a constant in the life of residents living near the dump sites. In many cases the spread of the odour will cover kilometres together becoming an integral part of the residents lives and slowly giving rise to health issues and air pollution. And this everlasting smell makes the surrounding areas unsuitable for further development in terms of infrastructure or economy. Hence addressing this is not only crucial in terms of well-being but also for the overall development of a region to its actual potential.

One such case is of Mangaluru city dump yard or famously known as Pacchanady dump yard after the name of the village it is located in. Mangaluru on an average generates about 310-320 tonnes per day (TPD) of solid wastes, with a daily collection frequency of 310 TPD. The waste collected has a composition of 60% of organic, 25% of inorganic, 5% of combustible and 10% of recyclable wastes. Even though 200 TPD of waste is aerobically composted through Windrow method and 25 TPD of waste is by vermi-composting method in recent years, still the Rejects from the compost plant are transported to sanitary landfill site which is creating a huge problem in many areas.

Apart from other issues faced the odour nuisance has exponentially increased over the years. This dump yard spreads foul smell approximately to half a kilometre radius which intense especially during the monsoon season causing the people living in nearby areas to face lots of discomfort and health issues. Along with residential areas, the dump yard is very near to many educational institutes that are running in Vamanjoor area. And this unpleasant smell has caused a lot of media attention over the years but still stands as one of the unsolved problems in the city.

This paper intends to review and discuss the possible practical solutions to the problem Mangaluru City Dump yard.

## II. LITERATURE REVIEW

Tran et al (2020) discussed about the impact of odour from a landfill site in Vietnam on surrounding areas. The odour was measured in three areas which were at a distance of 1.5 km, 8.32 km and 10 km from the landfill. The concentration of odour was intense at a distance of 1.5 km. Additionally odour concentration and people's perception of odour varied with geography. Questionnaire was conducted and the data were processed. From the investigation, it was observed that the odour concentration for area at 1.5 km was  $109.75 \pm 39.46$  ou/m<sup>3</sup>.

Szalata et al (20221) assessed the odour quality of the air in the vicinity of a landfill site using a case study of a waste management plant that processes non-hazardous and inert waste as an example. An analysis of the impact of the facility under study on the odour quality of the air was performed based on a mathematical modelling system to assess the impact of investments in air quality both in Poland and worldwide. The study concluded that the analysis of the plant's odour impact clearly indicates a significant impact on the air quality in the studied area.

Gao et al (2021) studied the atmospheric quality of typical landfills in the Yangtze River delta by monitoring through the sampling sites in landfills based on the opening membrane area. Study also involved determining the variety and complexity of volatile organic compounds (VOCs) along with the landfill odour. Out of 120 VOCs, 67 malodorous VOCs with significant variations were categorized into six classes of compounds under all test conditions. The results of the study provided essential information to enhance understanding the actual odour emission intensity and characteristics of landfill and the migration, transportation and influence of odourant emissions on the working surface of the landfill.

## III. TYPES OF ODOUR CONTROL METHODS AND TECHNOLOGIES

### Catalytic oxidation

In the presence of a catalyst, a catalytic oxidation reaction can be pushed to proceed at much lower temperatures (for example, 200°C). The benefit of this technique over thermal oxidation is therefore the decrease in energy input needed. In situations when auto-thermal operation is impractical and heat cannot be efficiently employed elsewhere, catalytic systems are consequently preferable. To eliminate different VOCs under a variety of process conditions, a catalytic oxidizer can be employed with a variety of transition and precious metal catalysts.

### Mist Filtration

While gases are the main culprits for scent, particles in the fumes can also be a problem. High concentrations of moisture are typically present in odourous air streams. A significant amount of the water vapour will condense if the vapour discharge can be cooled below 40°C, lowering the amount of gases that must be burned. For this, mist filters may be utilised. Solids and liquids can be taken out of the gas stream using mist filters. If these particles are the source of the odour, the odour will also be reduced.

### Incineration

Incineration is the process of oxidising an odour by burning it with fuel and air to produce carbon dioxide and water. Temperatures between 750°C and 850°C are required for the reaction to occur. This is a reflection of the heat needed to keep the reaction going at low concentrations with additional process heat losses, and it is typically above the auto-ignition temperature of most solvents and other VOCs. If there is enough oxygen supply, the destruction efficiency in this regime is close to 100%. Depending on the fuel and air ratio, flame temperature, and smell composition utilised, additional chemicals may occasionally arise. Carbon monoxide, nitrogen oxides, and sulphur oxides are only a few examples of these substances.

### Wet scrubbing/ Absorption

Both chemical treatment with a suitable reagent and absorption in a suitable solvent are used in wet scrubbing of gases to remove odour. Hot, wet streams must be cooled before coming into touch with cleaning agents. If you don't do this, the scrubbing solution will heat up and become less effective, and water vapour condensation will dilute the scouring medium.

Systems for wet scrubbing or absorption can be packed tower systems or venturi systems. Co-current scrubbers known as venturi systems accelerate the gas stream into a high density liquid spray. The aqueous droplets subsequently contact particulates in the gas stream at a high relative speed. In a disengagement tower, inertial forces are subsequently used to detach the resulting conglomerated particle from the gas stream. The high density spray also offers a reasonable mass transfer for contaminating gas absorption. In most cases, packed towers are counter-current scrubbers that use high surface area media as a contact zone for the gas stream with the appropriate scrubbing liquid. The media enables high efficiency mass transfer to remove gaseous pollutants by >99.9%.



When unsaturated organic compounds are the source of an odour, an oxidising agent, such as chlorine, diluted sulfuric acid, or sodium hydroxide, may be required to neutralise the odour.

When the pungent gases are soluble or emulsifiable in a liquid or react chemically in solution, absorption is appropriate. To handle acid gas streams, ammonia, or streams with particulates that could damage other equipment, wet scrubbing is a beneficial method. When the amount of offensive gas to be cleaned exceeds 5000 cubic metres per hour, it has been suggested that liquid scrubbing becomes more economically advantageous than incineration and adsorption on activated carbon.

### Condensation

Condensation is the process of converting a gas or vapour to liquid. Any gas can be reduced to a liquid by sufficiently lowering its temperature and / or increasing pressure. The most common approach is to reduce the temperature of the gas stream, since increasing the pressure of a gas can be expensive.

Simple, reasonably priced condensers are used to cool and condense a vapour stream using either water or air. High removal efficiencies of the majority of gaseous contaminants cannot be achieved unless the vapours will condense at high temperatures because these devices are typically not necessary or capable of reaching low temperatures (below 100oF). To lower the price of the control system, condensers are frequently employed as pretreatment equipment. To lessen the overall volume of gas that needs to be treated, they can be employed before adsorbers, absorbers, and incinerators.

### Bio-filtration

This technique is becoming a popular and effective means of eliminating odours caused by biological processes. A natural process that takes place in soil and has been used for commercial purposes is bio-filtration. Microorganisms found in bio-filters oxidise inorganic gases and vapours into odourless components like water and CO<sub>2</sub> and break down volatile organic compounds (VOCs). The bacteria are in close contact with the odourous gases because they are supported by inert materials and thrive on them. The procedure continues on its own. Compost, straw, wood chips, peat, soil, and other reasonably priced biologically active materials can all be used to make bio-filters. Two common bio-filter configurations for odour control.

The soil-bed filter is a different kind of bio-filter. Here, a porous soil with an usual depth of 60 cm is allowed to act as a conduit for the pungent gas stream. The decomposition of the odourous chemicals is carried out by soil microorganisms.

## IV. MANGALORE CITY DUMP YARD

The dump yard is located at the outskirts of the city of Mangalore but the developing city includes the outskirts areas like Vamanjoor, Pacchanadi area making the dump yard surrounded by residential as well as agricultural fields.

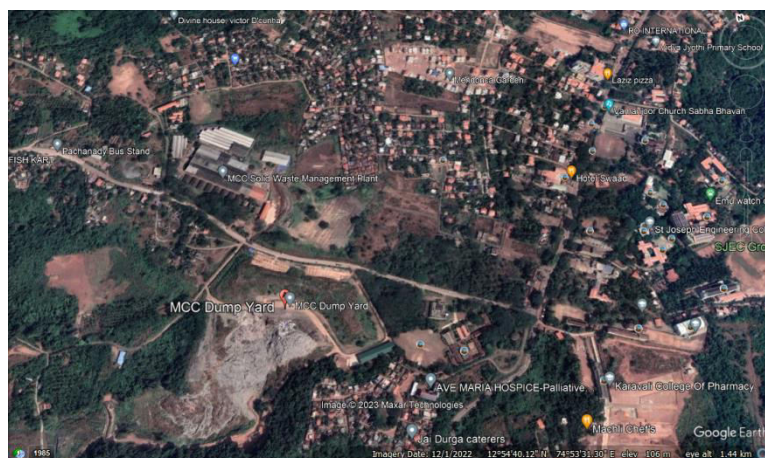


Fig.1: Mangaluru City dump yard in Pacchanadi village surrounded by residential, Educational and Agricultural areas

The dump yard consist of landfill, an open area for storage of waste, a processing unit for recycling of plastic and composting unit. The odour is very intense during rainfall and spreads to as far as 2 km. This has been a nuisance to the

residents and other people working or studying in nearby institutions. In order to mitigate or to reduce the impact of the odour nuisance a odour controlling mechanism using multiple filtration unit should be installed. This odour filter works on the principle similar to the water purification process. The suction fans installed in the filter (fig 2) sucks the air surrounding the filter and sends it to the first filtering layer of HEPA filter where smaller dust particles and other particles are removed. Then the air is passed through the activated carbon layer which removed the odour causing gases from the air then the air is passed through the last medium made of bacteria which essential removes the remaining odour filled gases by digesting them. Finally the purified air is passed from the out let. This filter should be installed in the waste collection and storing place of the dump yard where intense odour generates due to the decomposition of organic compounds and where it's easier to guide the air to a single direction.

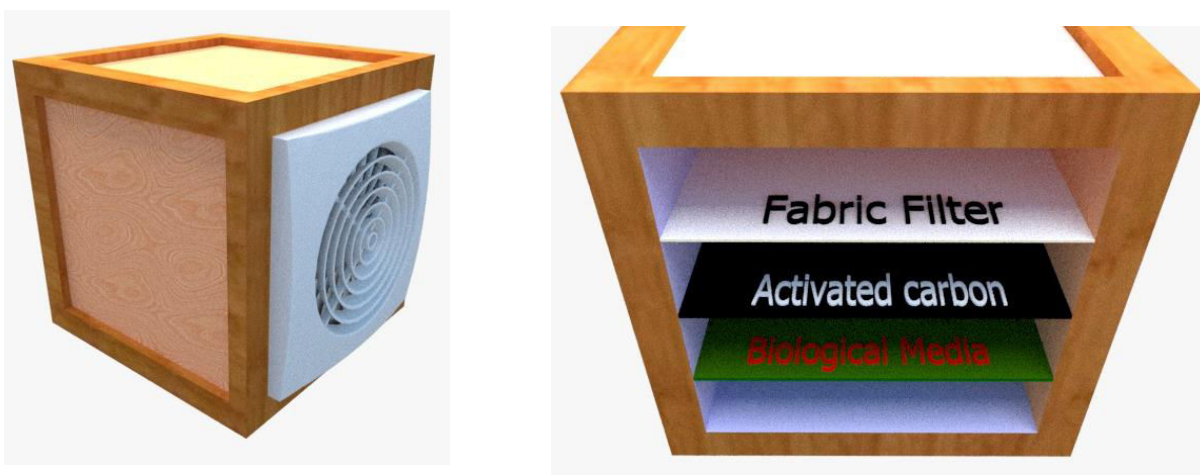


Fig.2: 3-D Model of the proposed odour control mechanism with multiple filtration units

## V. CONCLUSION

The problem of odour in a landfill or waste treatment plant is a common nuisance at all the places. But if the same nuisance gets out of control can result in air pollution and health hazards to the public. Though there is no 100 % solution to the problem. From the study of various methods of odour control measures the economical choice for the dump yard of the Mangaluru city was found to be Bio filtration process. Based on that a multi stage filtration unit was proposed as a better option to reduce the unpleasant odour at the site.

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**INNO SPACE**  
SJIF Scientific Journal Impact Factor  
**Impact Factor: 8.423**



**ISSN** INTERNATIONAL  
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