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# CURE OF INOPERABLE MUNICIPAL SOLID WASTES BY FORMULATED MICROBIAL SOLUTION

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## INTRODUCTION

Pollution is defined as undesirable changes occur in water, land and air (Odum, 1977). Due to population growth, industrialization, urbanization and economic growth, a trend of significant increase in municipal solid wastage (MSW) generation has been recorded world-wide. MSW generation, in terms of kg/capita/day, has shown a positive correlation with economic development at world scale. Due to rapid industrial growth and migration of people from villages to cities, the urban population is increasing rapidly.

Generally in India, MSW is disposed of in low-lying areas without taking proper precautions or operational controls. Therefore, municipal solid waste management (MSWM) is one of the major environmental problems of Indian mega cities, SWM involves activities associated with generation, storage and collection, transfer and transport, treatment and disposal of solid wastes. But, in most Indian cities, the MSWM system comprises only four activities, i.e., waste generation, collection, transportation, and disposal Poor collection and inadequate transportation causes the accumulation of MSW at every nook and corner. The management of MSW is going through a critical, phase, due to the unavailability of suitable facilities to treat and dispose of the larger amounts of MSW generated daily in metropolitan cities. Adverse impact on all components of the environment and human health occurs due to unscientific disposal of MSW (Gupta et al.; 2007, Jha et al., 2003; Sharholy et al., 2007). The MSW amount is expected to increase significantly in the near future as India strives to attain an Industrialized nation status by the year 2020 (Van Beukering et al., 1999). MSW management encompasses planning, engineering, organization, administration, financial and legal aspects of activities association with generation, storage, collection, transport, processing and disposal in an environmentally compatible manner adopting principles of economy, aesthetics, energy-conservation and opportunities (Jin et al, 2006). The management of MSW requires proper infrastructure, maintenance and upgrade for all activities. This becomes increasingly expensive and complex due to the continuous and unplanned growth of urban centers (Omran and Gavrilescu, 2008). The problems in providing the desired level of public service in the urban centers are often attributed to the poor financial status of the managing municipal corporations (Furedy, 1990).

Solid waste management has become a major environmental issue in India. Generation of solid waste depends on many factors like culture and nature of the people, the socio-economic conditions, its commercial importance, and its industrial base (Melosi, 2005). It is

observed that the total MSW generated by 299 class-I cities is 48 134 TPD (tones per day). Out of this, 62.4% solid waste is generated by only 23 metropolitan cities.

The national average for class-I cities is 0.376 kg/person/day. The per capita MSW generated daily in India ranges from about 100 g (gram) in small towns to 500'g in big towns. The population of Mumbai grew from about 8.2 million in 1981 to 12.3 million in 1995, registering a growth of about 40%. On the other hand, the MSW generated in the city increased from 3200 TPD to 5355 TPD in the same period. This clearly indicates that growth in the MSW in our country has outpaced the population growth in recent years. This trend can be ascribed to our changing lifestyle, food habits, and living standards. A survey conducted by CPCB (Central Pollution Control Board) puts the total municipal waste generated from class I and II cities to about 18 MT (Million tones) in 1997 (CPCB 2000). The present annual solid waste generated in the Indian cities has increased from 6 MT in 1947 to 48 MT in 1997 and is expected to increase to 300 MT/year by (CPCB 2000)

Solid waste generation is directly related to the economy of a country. As the society becomes richer, waste generation increases (0.2>>1.5 kg/person/day) while the traditional recycling practices tend to decline. The US (United States), the EU ( European Union), and Japan are by far the world's biggest producers of solid waste, with the US Producing about 14 times more than Japan and the EU countries (US 200MT, Japan 50 MT).

**MATERIALS AND METHODS**

In the present investigation, we prepared a specially formulated microbial solution to decompose the waste. Basically the FMS is based on Effective Microorganism (EM) Technology with the locally available microorganism.

**Description of Formulated Microbial Solutions (FMS)**

The FMS contains different strains of bacterial and fungal species. The Bacterial species are *Lactobacillus plantarum, L. casei, Rhodopseudomonas palustrus* (photosynthetic bacteria), *Cellulomonas fimi.* The fungal species are *Saccharomyces cerevisiae, Candida utilis* (yeasts), *Streptomyces albus* (actinomycetes), *Aspergillus oryzae* and *Mucor hiemalis* (fermenting fungi). These microorganisms are isolated from soil and grown in specific media. From the specific media the microbes were taken and cultured in media which has common nutrients for all microbes. The cultured microbial solution was used for treatment.

**The reason for choosing this FMS:** Non-pathogenic, Wide range of pH and temperature tolerance, Co-existing nature, Facultative anaerobic and rapid decomposing ability.

**Preparation of FMS for field applications:** The FMS was prepared in the form of a mother culture. The cell count in the mother culture is more than $10^9$CFU. Before to apply to the field the mother culture was extended or activated. The activated culture is called application culture. 1L mother culture was mixed with 50L chlorine free water (1:50). There after 800 gms of jaggery. This was kept for 7 days under anaerobic conditions. After 7 days the mother culture was ready for application.

The nature of application culture is include pH of 5-6.5, Straw yellow to Dark brown color, Slightly souring odor (due to fermentation), Density of 1 (As such water) and Cell count is 5 X $10^6$ to $10^7$CFU.

In the present study FMS is calculated as one liter mother culture can decompose up to 5 tons of Municipality Solid Waste in favorable condition. Three heaps of MSW were made. Each one having 150 kg capacities. First heap is called control; it will be not going to any process. In the second one, first week alone sprays the FMS then weekly once spray the water to maintain the moisture. In the Third one from first week to last week spraying water alone to maintain the moisture. After 8 week sample have been taken from all heaps and under gone physic chemical analysis in a lab. Further the result under go to the statistical analysis to check the significance**.** During the preparation of Microbial solution Water and jaggery were mixed with FMS mother culture in a barrel. After 7 days the Formulated Microbial Solution mixture becomes application culture. First heap was called control, the second one was going to treat with formulated microbial Solution in first week, there after going to treat with water. The third one was going to treat with water. After three weeks inspection was made, and the changes was noted from all heaps. First heap become fully dried. The second heap size significantly reduced the moisture content around 40 %. Comparatively the decomposition rate is high in second heap it might be microbial action. Third heap size was considerably reduced. The moisture content around 40 %. After 8 weeks the size of the all heaps are reduced. Most of the decomposable materials are decomposed in second heap compare with first and third.

## RESULT AND DISCUSSION

### Comparative Study of the compost

**pH:** pH value of the control, municipality solid waste treated with FMS and the municipality solid waste treated with water were 7.47,7.12 and 6.45 respectively.

**Electrical conductivity (EC):** The electrical conductivity of the control was 1.94 dSm-1, compost treated with FMS was 1.12 dSm-1, compost treated with water was 1.45 dSm-1

**Organic carbon (%):** The organic carbon of the control, municipality solid waste treated with FMS and the solid waste treated with water were 14.20, 11.28 and 10.45 respectively.

**Nitrogen (%):** The nitrogen content of the control was 0.72, compost treated with FMS was 0.95 and compost treated with water was 0.85.

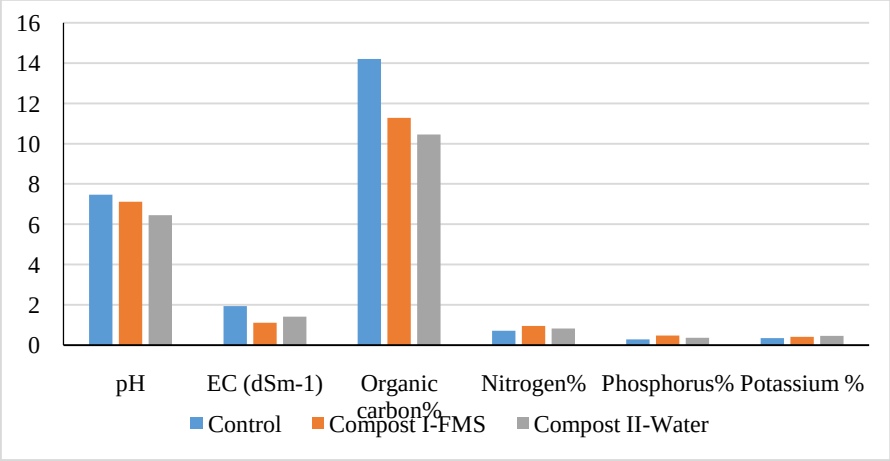
**Phosphorus (%):** The Phosphorus content of the control was 0.28 compost treated with FMS was 0.47 and compost treated with water was 0.37

**Potassium (%):** The Potassium of the control, municipality solid waste treated with FMS and the municipality solid waste treated with water were 0.35, 0.41 and 0.46 respectively.

**Table 1: Results of comparative study of Control, Compost I and Compost II**

| S. No. | Parameters | Control | Compost I-FMS | Compost II-Water |
|---|---|---|---|---|
| 1 | pH | 7.47 | 7.12 | 6.45 |
| 2 | EC ($dSm^{-1}$) | 1.94 | 1.12 | 1.41 |
| 3 | Organic carbon% | 14.2 | 11.28 | 10.45 |
| 4 | Nitrogen% | 0.72 | 0.95 | 0.83 |
| 5 | Phosphorus% | 0.28 | 0.47 | 0.37 |
| 6 | Potassium % | 0.35 | 0.41 | 0.46 |

**Fig. 1: Comparison of Control, Compost I and Compost II**




The result clearly indicates the quality of the compost. The compost one contains high amount of nitrogen and phosphorus compare with control as well compost two. The first compost total nitrogen value was 14.45% and the total phosphorous value was 27.02% more than the compost two. But the compost two potassium value was 0.46 which was more than 11 % compare with compost one. In the overall quality of the compost the compost one was so good when compare with other two composts (Finnveden, 1996**)**.

Apart the quality of the compost the compost one nature and decomposition rate also high. The volume reductions were more compare with control and compost two. FMS application

on Municipal Solid Waste in the present study offers high hope in converting this into effective manure for farming (Richardson, 2003). In comparison with control and compost two the FMS treated compost one has more organic carbon, Nitrogen and Phosphorous. The was encouraging and it is suggested Municipal Solid Waste can be used as manure after ruling out the existence of pathogenic microbes, Since Municipality Solid Waste have been blamed for the transmission of Salmonella spp and other human diseases (Diwekar, 2005).

However Idris et al., (2004) reported that the colonization of lactic acid bacteria controls the population of pathogenic microorganisms such as *Salmonella spp., Enterococci* and *E. Coli.* The FMS in the present investigation has two strains of lactic acid bacteria *(Lactobacillus platarum and Lactobacillus casei)* which the investigation believes could control the pathogenic microbes. In the present study majorly focus on treatment and utilization of municipality solid waste as manure for agriculture. In that context treatment by formulated microbial solution has been tried for treatment of municipality solid waste. After the investigation it increases the hope to make the manure effectively through FMS.

The present study was envisaged to treat the municipality solid waste by using eco-friendly cost effective method with the help of Formulated microbial Solution (consortium of Microorganism). An effort was also made to municipality solid waste converting to effective and natural manure through Formulated Microbial solution (Tsiliyannis, 1999). The Formulated Microbial solution contains nine different species of microorganism, which are non-pathogenic, eco-friendly, facultative and co existing nature. There was three heaps of Municipality Solid Waste has been taken for the experiment. The first heap was called control, it was not gone for any treatment. The second heap called compost one. It was treated with Formulated Microbial Solution (FMS) in the first, there after it was treated with water alone to maintain the optimal moisture content for compost. The third one called compost two; it was treated with water alone. Every week water spray over the heap to maintain the moisture. After eight weeks samples has been taken from each heap and sent to analysis. From the analysis result the compost one means which was treated with formulated microbial solution was so good compare with control and compost two. Some literature said, the lactic acid bacterium controls the pathogen from the waste (Turan et al., 2008). Fortunately (FMS) contains two strains of lactic acid bacteria which is helpful to controls the pathogens. In this case microorganisms play a vital role in improving the nutrient contents of nitrogen, phosphorus and potassium considerably.

**REFERENCES**


1. Odum EP (1977). Fundamentals of Ecology. W.B. Saunders Company, London.
2. Gupta S, Choudhary N and Alapet BJ (2007). 'Bioreactor Landfill for MSW Disposal in Delhi. Proceedings of the international Conference on Sustainable Solid Waste Management, Chennai, India. 474-481.
3. Jha MK, Sondhi OAK and Pansare M (2003). Solid Waste Management- a case study. Indian Journal of Environmental Protection 23 (10), 1153-1160.
4. Sharholy M, Ahmed K, Vaishya R and Gupta R (2007). Municipal solid waste characteristics and management in Allahabad, India. Waste management 27 (4), 490-496.
5. VanBeukering P, Sehker M, Reyer Gerlagh R and Kumar V (1999). Analyzing urban solid waste in developing countries: a perspective on Bangalore, India, Working Paper No 24, Collaborative Research in the Economics of Environment and Development (CREED), Institute for Social and Economic Change (ISEC), Nagarbhavi, Bangalore, India.
6. CPCB (2000). Solid Waste Management Rules. Annual report of Central pollution Control board-2000.
7. Idris A, Inane B and Hassan MN (2004). Overview of waste disposal and landfills /drums in Asian countries. Material Cycles and Waste management 16, 104-110.
8. Diwekar U (2005). Green process design, industrial ecology, and sustainability: A systems analysis perspective, Resources, Conservation and Recycling, 44, 215-235.
9. Finnveden G (1996). Solid waste treatment within the framework of life-cycle assessment – Metals in municipal solid waste landfills, Journal of Life Cycle Assessment, 1, 74-78.
10. Furedy C (1990). Social aspects of solid waste recovery in Asian cities. In Environmental sanitation Reviews, vol.30, 2-52. ENSIC, Asian Institute of Technology, Bangkok.
11. Jin J, Wang Z. and Ran S (2006). Solid waste management in Macao: practices and challenges, Journal of Waste Management, 26, 1045-1051, 2006.
12. Melosi MV (2005). Garbage in the Cities: Refuse, Reform and the Environment, Revised Edition, University of Pittsburgh Press, Pittsburgh Pa.
13. Omran A and Gavrilescu M (2008). Municipal solid wastes management in developing countries: Perspective on Vietnam, Environmental Engineering and Management Journal, 7 (4), 469-478.
14. Richardson D (2003). Community-based solid waste management systems in Hanoi, Vietnam, MSc Thesis,Toronto, Ontario, Canada.
15. Tsiliyannis CA (1999). Report: Comparison of environmental impacts from solid waste treatment and disposal facilities, Journal of Waste Management and Research, 18, 231-241.
16. Turan NG, Çoruh S, Akdemir A and Ergun SN (2008). Municipal solid waste management strategies in Turkey. Journal of Waste Management, in press.

**FMS preparation photographs**

**Application of Culture**

**After Three Weeks of Treatment**