

Design and Development of Municipal Solid Waste Management System for Aligarh city, Uttar Pradesh

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ABSTRACT: Municipal solid waste management (MSWM) is one of the major environmental problems of Indian cities. Improper management of municipal solid waste (MSW) causes hazards to inhabitants. Various studies reveal that about 90% of MSW is disposed of unscientifically in open dumps and landfills, creating problems to public health and the environment. In the present study, an attempt has been made to provide a comprehensive review of the characteristics, generation, collection and transportation, disposal and treatment technologies of MSW practiced in India. The study pertaining to MSWM for Indian cities has been carried out to evaluate the current status and identify the major problems. Various adopted treatment technologies for MSW are critically reviewed, along with their advantages and limitations. The study is concluded with a few fruitful suggestions, which may be beneficial to encourage the competent authorities/researchers to work towards further improvement of the present system. Issues related to waste management in the context of Indian Cities still requires a path finder as most of the SWM planners and Executers are still in the dark which part of the SWM rule 2002 needs to be addressed in the primary stage.

KEYWORDS: Municipal solid waste, Solid Waste Management, Aligarh, Sanitary Landfill, MSW

In keeping with global trends, the systems are being oriented to concentrate on sustainability issues; mainly through the incorporation of 3R (reduce, reuse and recycle) technologies. However, degree and nature of improvements toward sustainability are varying and depend on the economic status of a country.

I. INTRODUCTION

Solid wastes are all the discarded solid materials from municipal, industrial, and agricultural activities. The objective of solid wastes management (SWM) are to control, collect, process, utilize and dispose of solid wastes in an economical way consistent with the public health protection.

[1] Increase in population, rise in life standard and increase in urbanization have resulted to a surge in variation of solid waste. In 2002, the waste generation estimation globally was 1.4 billion tons out of which 1.2 billion tons was industrial and 1.7 billion ton was municipal solid waste (MSW). By 2040, it is estimated that generation of MSW around the globe will be approx. 95 billion (Ajnav et al., 2008). In the same way as other developing nations, India is confronting huge test in dealing with the expanding amount of Municipal Solid waste (MSW) because of its fast population development, change in way of life, relocation of individuals from rural to city zones, and numerous other reasons.

[2] Solid wastes of organic origin include: municipal wastes, agriculture based industrial wastes, horticultural wastes, waste originating from animals, farming wastes and remains. Economic benefits and minimum environmental pollution are the main objective which can be achieved by having effective waste management system. Because of expanding energy demands, budgetary requirements and environmental issues, organization everywhere throughout the world have prescribed different rules and worked on numerous issues related to management of waste.

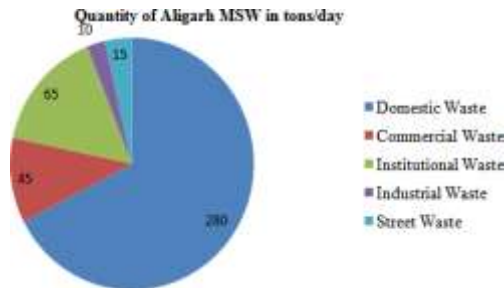


Fig 1(a) Quantity of Aligarh MSW in quality generated per day in Aligarh city.

II. OBJECTIVE :

The aim of this study is to present the status of MSW and other important aspects like challenges for integrated SWM, intricacy of PPP mode, role of rag-pickers, prevailing practices of MSWM, and the rules pertaining to waste management in India. In developing countries like India, it is important to plan and implement sustainable low-cost SWM strategies. Lack of awareness, inappropriate technical knowledge, inadequate funding, unaccountability, implementation of legislation and policies are major reasons for the failure of MSWM. Issues like proper site selection, adequate financial support, and improper human resource management, can be overcome with enhanced capacity, improved procedures and training. The solution to the problems associated with development and adoption of appropriate technologies and lack of trained manpower will require at realistic time frame and not only central government bodies, but state governments also have to take various actions for strengthening MSWM in the country. The intricacies that could arise during implementation should be taken into account, so that decisions and strategies can be based on ground actualities.

III. METHODOLOGY

Our Hon'ble Prime Minister Narendra Damodar Das Modi launched an important project "Mission for sanitary India" on 2nd October 2014 on the birth anniversary of Mahatma Gandhi. This "Clean India Campaign" is the biggest ever cleanliness drives in the country. In which Prime Minister had appealed to each Indian citizen to get involved in the mission and make it successful. The main problem in our country is open defecation. More than 72 percent of rural people in our country are used to go open for excreting behind bushes, in fields or on roadsides. Which led to various other problems like untimely deaths of children due to spread of infections and diseases and most importantly rapes of young girls who go to deserted places to relieve themselves. Above all, the project

aims at creating awareness among people about the need for proper sanitation and hygienic facilities.

A. Status and challenges of SWM.

In India, some of the future challenges for the management of solid waste are increasing quantities and changing composition, increasing severity of adverse impacts, increasing cost of waste management, limited policy framework and lack of political priority.

Aligarh city is situated in the western part of Uttar Pradesh on Delhi-Kolkata Railway link and historical Grand Trunk (GT) road. It is situated at a distance of 130 km southeast of Delhi, the capital city of India. The Aligarh District has an area of about 5014 sq. km with city occupying an area of about 34 sq. km. The population of Aligarh city is about 8, 72,575 as per census 2011 which makes it medium-sized as per Indian statistics. The population density in the district is 1007 per Km² and in the city 14115 per Km². The city lies at 185m above the mean sea level (MSL) in a low-lying area in between plains of two major plains, Ganges and Yamuna.

B. Strategies for Sustainable Municipal Solid Waste Management in Aligarh City:

1. Bringing the attitudinal and behaviour changes among the population about segregation of waste and sanitation improvement.
2. Public awareness through informing and educating the masses on various aspects of solid waste management and achieve the target of receiving segregation waste from each household.
3. Bringing down the involvement of NGOs.
4. Creating public participation in planning and management of MSW activities.
5. Publishing of the magazines and buck lets in the newspaper.
6. Awareness program started in the schoollevel.
7. Social Mobilization.
8. Integration and involvement of private sweepers and rag pickers in improving management.

IV. EXPERIMENTATION

The MSW collection conducted in Aligarh city basically two types:

First Stage:

Door to Door Collection- The waste collected from door to door is transported to dustbins and open dumps. In this stage collection is not very efficient even through large number of private garbage collectors is engaged in waste

collection from door to door at a nominal rate. Due to lack of awareness most of the people drop the waste outside their residence which normally turns into small dump points and becomes difficult to collect. A part of such garbage is blown into drains which choke them. Such garbage is swept away by street sweeping and lifted by means of hand cart, rickshaw trolley by Nagar Nigam workers and private bodies to the nearby dump points which are known as secondary dump point.

Second Stage:

Waste filled bins are replaced with empty bins with the help of dumper placer and transfer to the dump site. Waste from open dumps is collected in tractor manually or by JCB sand loader and finally transported to the designed dumpsite.

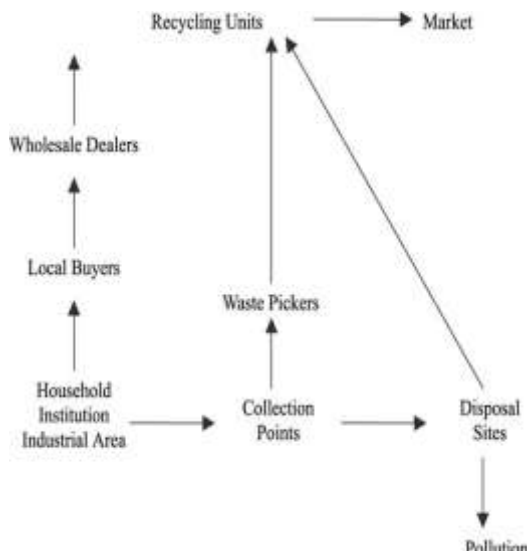


Fig 1(b)- Solid Waste Management flow diagram in Aligarh City.

V. TEST RESULT ANALYSIS AND DISCUSSION

In order to meet the challenges of municipal solid waste management there is a need to develop a better technology or method through which the waste can be converted into useful material. The biodegradable organic waste can be processed into ecofriendly organic manure. Organic manure nourishes the soil fertility, increases the soil aeration and also minimizes environmental pollution. Now, it has been realized throughout the world that the use of chemical fertilizers and other chemicals is harmful to soil productivity and also a cause of water and air pollution.

Study has revealed that the amount of municipal solid waste collected by the private body in Aligarh city is one of the order of 415 tonnes per

day. Depending on the type of locality like in thickly populated commercial areas and posh colony, the frequency of collection is at least once in a day, while in other areas it is only once in 3-5-days. Present practices of SWM in Aligarh city are very weak. Approximately 80 percent of the collected wastes are disposed as open dumping. There is no sanitary landfill in Aligarh city. The city is no exception and management of solid waste disposal is passing a problem of this rapidly developing city of western Uttar Pradesh, on most accounts. Aligarh city is regarded to be one of the most polluted cities of the country due to its cultural and physical setting. Primarily, an old city like Aligarh with low relief and slope, with dense urbanization and cozy pathways and ever increasing uncontrolled population load, modern civil engineering projects with state of art GIS and GPS technology can be prove to be a boon for planning, maintaining, formulating, and simulation along with models that may come out for next 10, 20 and 50 years. Sustainability requires most modern technology tool like LIDAR survey along with total station survey of entire city and thus a chain of all sanitary like can be made which can be further joined and rejoined keeping with the slope aspect minimal. A GIS database generated inform of polygon, point and line with feature information of number of households, family groups; linked up can serve to plan for other civil projects such as all underground sewage system or installation of real time monitoring system at selected places.



Fig.1:-Solid waste and discarded materials in drain affect the Ecosystem, near Jamalpur, Aligarh.



Fig.2:-Accumulation of solid waste and waste water in and around residential areas, creating ideal breeding ground for insects and pests near Pratibha

Colony in front of Nagar Nigam Workshop, Aligarh. (Dirty still water).

Design of Sanitary landfill for Aligarh City

The landfill is envisaged for necessary lining system, using the locally available clay after compressing, named as Engineered Sanitary Landfill.

Quantity of solid wastes/day = 451,000kgs = 451 tonnes

As per BIS

Thickness of clay liner = 0.5 m

Height of the each lift = 3.0 m

No. of lifts provided = 1.0 m

Thickness of cover between lifts = 0.2m

(0.15 m to 0.3 m)

Diameter of lateral and main drains provided = 0.15 – 0.2m

Thickness of top cover = 0.65 m (0.6 m- 0.8 m)

Assume total height of landfill = 4.5 m

Volume of solid wastes to be dumped/day =
 Weight / Density.

Landfill Infrastructure and layout

1. Site fencing: all around the landfill.
2. Weigh bridge (computerized): 50t capacity with office.
3. Administrative office: 10m x 5m building.
4. Equipment workshop and garage: 30m x 20m building.
5. Temporary holding area: 20m x 10m (To hold one-month waste).
6. Leachate treatment facility: 20m x 10m tentative.
7. Surface water drain: Adjacent to arterial road.
8. Along periphery.
9. Leachate collection pipe: Adjacent to arterial along periphery.
10. Access roads Main access road: 7m wide from main road to landfill area.
11. Arterial road: 3.5m wide all along the periphery.

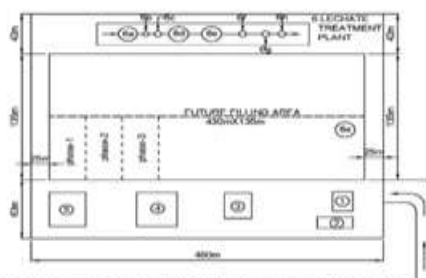


FIG. 1: LAYOUT OF ENGINEERED SANITARY LANDFILL

1. Weigh bridge (10m x 10m),
2. Office room (10m x 5m),
3. Inspection/screening facility (10m x 10m),
4. Equipment workshop (30m x 30m),
5. Temporary holding area (30m x 30m),
6. Effluent treatment plant, 6a-Collection sump (5m dia, 7m depth), 6b-on-line lime dosage system, 6c-online poly electrolytic dosage system, 6d-clarifier (6m dia, 7m depth) 6e-clarified water sump (5m dia, 7m depth), 6f-pressure sand filter (0.90m dia, 4.3m depth) 6g-pressure carbon filter (0.60m dia, 4.3m depth), 6h-on-line chlorine dosage system.
7. Phase I, Phase II etc.

VI. CONCLUSION

The study of concluded that the present policy and infrastructures are inadequate in dealing with the enormous quantity of MSW generated in the city. MSWM in Aligarh city is unsatisfactory and thereby needs immediate attention. Increase in the quantities of MSW due to rapid urbanization, commercialization and inability of providing daily collection service cause nuisance and health hazards. A2Z Pvt.Ltd. (NGO) had taken a big step towards improving MSWM practices by privatizing the collection and transportation of MSW. A Nationwide Real Time Monitoring system has also been launched by the Government of India in order to construct toilets under this campaign aiming to attain 100% open Defecation Free India by 2019. We should participate in this mission by meeting our hands together and taking this cleanliness mission as an important part of our life with the vision of clean India achievement through the effort of each and every Indian citizen and not by the effort of government only. Beside all these the government-imposed Mission for the Sanitary India Cess at the rate of 0.5 percent on all services, which are presently liable to service tax from 7th November 2015.

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