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Review Article

SOLID WASTE MANAGEMENT IN KANPUR CITY, INDIA, A DEVELOPING COUNTRY

ANSHIKA KUSHWAHA, TEJ PRATAP SINGH*

Department of Chemical Engineering, Bundelkhand Institute of Engineering and Technology, Jhansi, Uttar Pradesh, India.
Email: anshikakushwaha171@gmail.com

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ABSTRACT

The purpose of this research is to define the existing state of municipal solid waste (MSW) in Kanpur city to identify the main obstacles its efficiency and the prospects for improvisation of the solid waste management system in the city. The usual approach to problem solving is to survey previous work done in this subject area of solid waste management. Various studies say that 95% of MSW is disposed of unscientifically in open dumps and landfills, creating problems to public health and the environment. The amounts of waste generation have been increasing in India with increasing urbanization. Since higher education campuses about 90% are such as autonomous cities, they can act as a model for solid waste management (SWM) and enhance sustainable development. SWM is the controlled generation, storage, transport, processing, and disposal of solid waste considering public health, conservation, economics, and environmental conditions. Many developing countries such as India are lacking behind in SWM from the developed countries which are using advanced technologies along with efficient management. This paper will analyze the issues related to SWM Kanpur streets for becoming zero waste streets. Lack of awareness and improper collection, exposed transportation, inefficient processing, and disorganized disposal of solid waste are the major reasons for it. Some techniques would reduce the amount of waste diverted to landfills and the problems arising on streets due to solid waste, thus leading to zero waste streets. This paper identifies a need to implement a robust SWM at the Kanpur city in India.

Keywords: Solid waste management, Zero waste streets, Recycling, Waste classification, Technologies, Municipal solid waste.

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INTRODUCTION

Solid waste management (SWM) is one of the basic services arranged and administered by the municipal authorities in the country to enhance the cleanliness of the urban center. Solid waste open dumping refers to the act of discharging or otherwise disposing of solid waste in an environment outside of proper pollution management functionalities [1]. This word includes cases such as discharging or open dumping of solid waste into a water body (like a river, lake, or sea) or open dumping it at in the road side, in the wilderness, or in wetlands or open dumping it together with municipal solid waste. In fact, zero waste management emphasizes aspiration to minimize uses of resources or minimize consumption by society and maximize rinsing, recycling, repairing, redesigning, regenerating, reducing, remanufacturing, and reselling of products. Zero waste means 100% diversion of municipal solid waste (MSW) from landfill by achieving 100% recycling of waste, which is possible only when the holistic waste management plan and some innovative approaches applied to the present SWM system.

The management of MSW is going through a critical phase, due to the unavailability of suitable facilities to treat and dispose of the larger amount of MSW generated daily in metropolitan cities. Unscientific disposal causes an adverse impact on all components of the environment and human health. The management of MSW is going through a critical phase, due to the unavailability of suitable facilities to treat and dispose of the larger amount of MSW generated daily in metropolitan cities. Unscientific disposal causes an adverse impact on all components of the environment and human health [2-9].

Annually, about 12 million tons of inert waste are generated in India from street sweeping and in the landfill sites, it occupies about one-third of total MSW.

The main shortcomings are related to inadequate workforce, financial resources, implements, and machine required for effectively carrying out various activities for municipal SWM [10].

CLASSIFICATION OF SOLID WASTE

The solid waste generated from residences can be classified as biodegradable and non-biodegradable depending on its nature to undergo degradation process. In a broad sense, the solid waste can also be categorized as dry and wet. As solid waste is broadly classified into solid waste, wet waste and biomedical waste. A typical solid waste collected from the city of Jhansi shows presence of following materials: Card boards, carry bags, pins, containers, glass bottles, tin containers, plastic items, leather, papers, rags, etc. The size [11] of waste in not only dominated by population but also by other factors such as lifestyle type of locality and awareness about environment. Solid waste of every municipal corporation is diversified in nature.

The characteristics solid waste varies from different places. Factors such as income level, the sources, the population, social behavior, climate, industrial production, and the market for waste materials are influential [12].

National Environmental Engineering Research Institute has carried out studies in more than 50 cities and towns in India. The characterization of MSW showed that the waste consists of 30–45% organic matter, 6–10% recyclables, and the rest as inert matter [13].

OBJECTIVES

The basic aim of this study is to:

1. Identify the issues regarding minimum zero waste
2. Develop the awareness and responsibilities for both consumers and product manufacturers

3. Focus on domestic composting system and rag picking service
4. Develop zero waste picking service
5. Encourage the involvement of local NGO's in working on various environmental awareness programs
6. Privatize solid waste management facilities or contract for waste disposal services
7. Include the public about the importance and necessity of better waste management.

STORAGE AND COLLECTION OF MSW

Location and extent of the study area

Kanpur City is situated between the parallels of 25°26'N and 26°58' North latitude and 79°31E' and 80°34' East longitude. It is situated on the most important national highways No. 2 and 25 and state highway. Covering an area of 291.78 km^2 which consists f 3,415,058 persons (as per 2010 projected population) [14]. Kanpur is the biggest city of the state and it is the main center of commercial and industrial activities formerly known as Manchester of the country is now also called the commercial capital of the state. It is known for its cotton and woolen textile and leather industries. Apart from leather and textile industry, the fertilizer, chemicals, hosiery, two wheelers, and engineering industries are also operating prominently in the city. Kanpur city is divided into six zones and further subdivided into 110 wards Fig. 5.

Workers and staff

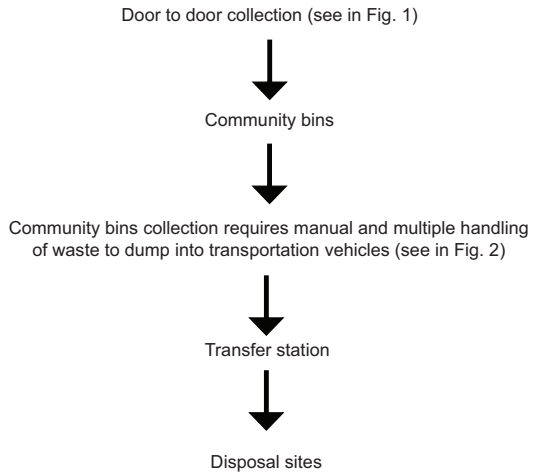
The number of workers and staff is limited. In general, the work-related health problems of MSW workers in India are respiratory, dermatological, eye problems, and injury [15]. Support systems are rather weak in assessing the appropriateness of the system. Weak coordination among the Kanpur Nagar Nigam (KNN), Jal Kal, and Jal Nigam involved in the development of asset (Jal Nigam), and the operations and management (Jal Kal – KNN) also posess a severe challenge which results in the accountability issues. The limited capacity of KNN reflects in the absence of community engagement and participatory means in the planning, operations, and management of the sewerage management system/service.

On-site storage

The role of KNN is most important for solving the problem of solid waste management.

On-site storage Fig. 1 spaces are the SDSs, transfer stations, and handover points, which receive wastes from primary sources and then the wastes are transferred from this point to the designated location for processing/recycling/treatment and mostly for ultimate disposal. There is no transfer station or handover point in Kanpur.

Collection



Integrated solid waste management system

Integrated waste Fig. 4 management is concerned with synthesizing a range of different option to deliver an environmentally and economically sustainable system for a particular area. To integrate a solid waste program, the program should address the needs of the community as a whole. In other words, it can be defined as waste generated from individual houses, apartments, public places, business, and industries should be taken into consideration for efficient management. Enough flexibility should be built into a program so that it can protect the environment. Hence, it describes an approach in which decisions on waste management take account of different waste streams.

Study site

The present research was conducted in selected wards of Kanpur city in zone 1 situated on the southern bank of river Ganga in the Northern Central part of the Kanpur City. It covers an area of 9.29 km^2 and consist 445,898 persons. It has 13 wards, namely, Laxmipurwa, Anwarganj, Sisamau South, Civil lines, Harbansmohal, Chamanganj, Patkapur, Maheshwarimohal, Generalganj, Parade, Chowk sarafa, Vijay Nagar, and Collectorganj.

Fig. 1: Rag picking services by Kanpur Nagar Nigam

Fig. 2: Collection of waste from the door of the houses (Kanpur Nagar Nigam)

Fig. 3: (a and b) Wastes collection from generation sources (www.weforum.org) and disposal in secondary points in zone 1

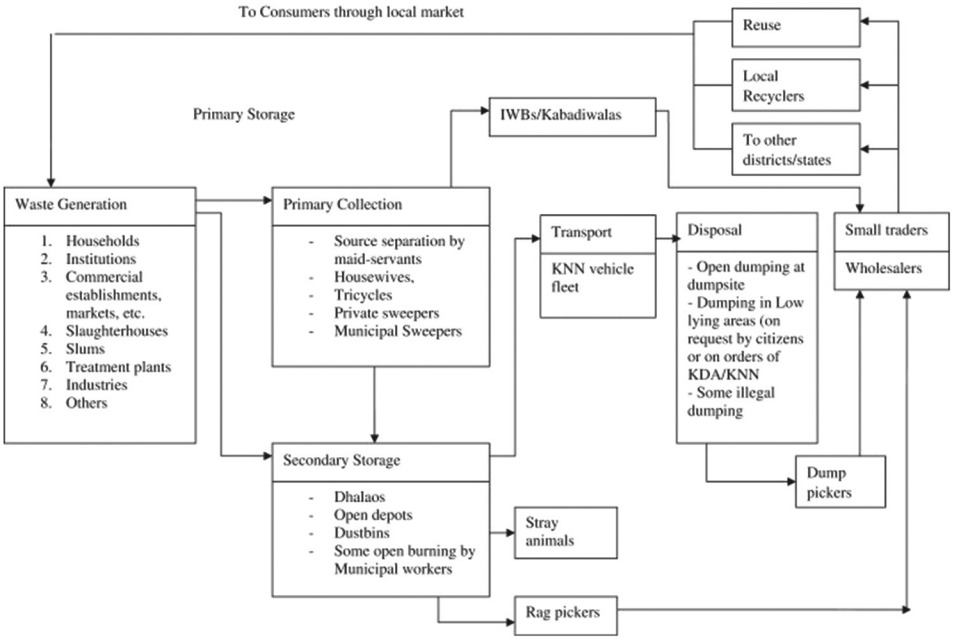


Fig. 4: Integrated solid waste management model

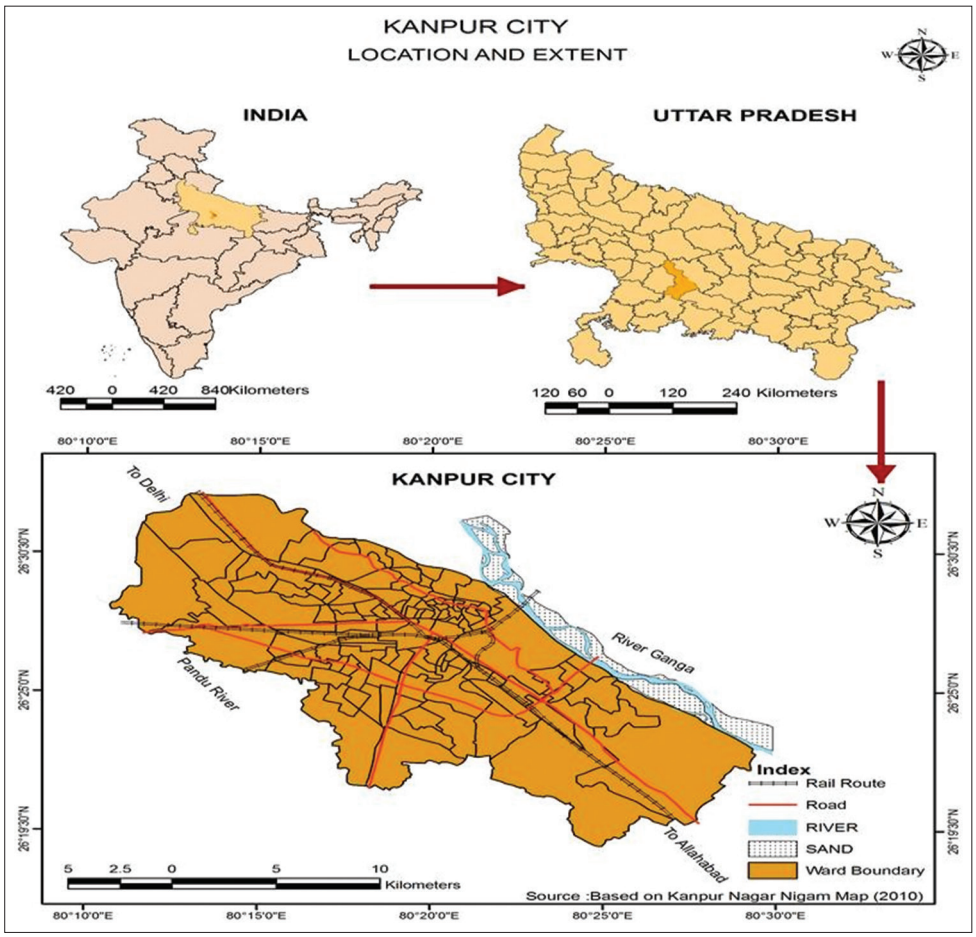


Fig. 5: Map of study area

Survey

Due to changing pattern of waste composition, emphasize needs to be given on its segregation and management. A survey should be carried out on generation and characterization of solid waste. To obtain a statistically reliable sample, large number of samples must be analyzed [16]. These data could be processed and conclusions could be derived.

Sampling analysis
Sampling analysis was performed in selected wards of zone 1 in Kanpur city. Samples were collected for characterization and quantification of biodegradable, non-biodegradable, and moisture content in collected solid waste sample.

Waste minimization and treatment
The MSW management includes and is not limited to the following components: Source control, reuse, recycling, composting, land filling, and energy recovery. In the studied cities, there is very low controlled or planned waste minimization program. Most of the recycling activities are conducted by self-employed workers or scavengers, as shown in Fig. 3.

Recycling
Recyling is processing used materials into new products. It reduces the consumption of fresh new raw materials, reduces energy usage, and reduces air pollution and water pollution. Recycling is the key component of modern waste reduction and is the third component of the "Reduce, Reuse, Recycle" waste. Source separation is the best process where different categories of recyclables and organics are separated at source, that is, at the point of generation, to facilitate reuse, recycling, and composting [17]. Informal sectors by various groups of community are playing an important role in recycling of solid waste in Kanpur. All the buyers of the recyclable items belong to the informal sector and only a few formal manufacturers are involved in using recyclable substance as raw material. However, in the studied areas, recycling is not practiced widely and effectively except for certain urban areas.

CONCLUSIONS

Rapid urbanization and population growth in the major area of Kanpur create a huge generation of MSW and the authority is unable to manage properly with the present management system, economic support, other resources, infrastructures, and technological capabilities. Door-to-door collection system needs to get support from all stakeholders with proper awareness, motivation, and commitment campaign. Existing on-site storage practices should be changed immediately by adopting properly designed and maintained secondary disposal sites or transfer stations or handover points, where it is applicable based on the prevailing socioeconomic aspects. Efficiency of wastes transportation to the ultimate disposal sites (UDSs) must be improved with the participation of private sector with strict terms and conditions. Present situation of UDSs requires improvement by providing a sanitary landfill mechanism in the existing sites. Recycling can be extended with wide varieties of articles both in the formal and informal sectors. Government support should be provided in composting, a prosperous sector for managing a huge amount of organic wastes in Kanpur. Since there is no single solution, the proposed techniques can be used to select an integrated solid waste management system based on the local needs, socioeconomic settings, technological capabilities to ensure the acceptability of the adopted system, and the environmental sustainability.

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