

Case Study

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Urban Solid Waste Management for Sustainability: A Case Study

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ABSTRACT

Keywords

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Solid waste predominantly, is any garbage, refuse or rubbish which include- domestic, commercial and industrial wastes especially common for disposal. Solid waste should be handled and disposed off properly or else it poses numerous risks. The main objectives of this is to examine the types and current amount of wastes created, estimation of existing solid waste management system and finally suggested a sustainable management system of household solid waste for Nagar Panchayat area. Qualitative field data represent that about 39% households produced 2-3kg waste per day and the majority percentages were organic waste (49%). Owing to unawareness about 68% households was not segregated their waste at home. Though 54% wastes were stored in the Nagar Panchayat dust bin, but 23% waste was thrown on the road side and 14% were anywhere. Results drawn from this research and suggested a sustainable management system will be useful for a Nagar Panchayat authority and planners, for proper management of solid waste and environmental sound city management.

Introduction

Improper handling and disposal of solid waste in open spaces poses dangers to human health as well as the environment. Waste workers and rag pickers who are involved in direct handling of solid waste are usually affected and suffer from chronic diseases. Moreover, it causes public places to appear ugly and also results in poor water, land, and air quality. Burning of heaps of waste generate greenhouse gases such as methane, carbon dioxide and nitrous oxide which could be the cause of global warming. Thus to reduce the effect of wastes on health and environment or aesthetics, Solid waste management should be undertaken. Solid Waste management is the "generation, prevention, characterization, monitoring, treatment, handling, reuse and

residual disposition of solid wastes" (Waste Management, 2013). The waste management strategies developed should aim at reduction of waste generation and maximum practical benefits from the products. The waste hierarchy includes: preventing the generation of waste, reducing the generation of waste i.e. by reuse, recycling and composting. The final action is to dispose in landfills and incineration. Waste is growing by leaps and bounds in India. With a population of over 1.22 billion, rapid urbanization and modernization of India is simply inevitable. One result of a rapid urbanization, a slowly reducing gap between urban and rural, changing consumption patterns and a growing population is the problem of waste.

Solid wastes include various types of wastes which are produced from our daily activities. In the Residential area household wastes production are depend on following factors such as, family size, behaviors and food growing season, and living style (Yousuf, 2005; Diaz *et al.*, 1993). Urban population and mechanization have been increasing rapidly and these are creates large amount of municipal solid waste which have an adverse effect on environment, daily life of urban peoples, and other stakeholders (Alamgir *et al.*, 2005), which is a big challenge for sustainable urban development (Chowdhury *et al.*, 2006). The Solid waste management (SWM) is also a part of the population (Shekdar, 2009). Management of Municipal solid waste (MSW) is one of the major environmental problems and hazards to inhabitants, which is causing and creating problems to the environment (Mufeed *et al.*, 2008). Urban solid waste management studies were carried out in Kanpur and Kolkata (Hina *et al.*, 2008; Arun *et al.*, 2010). SWM studies were carried out in Chennai using landfill lysimeters (Sri *et al.*, 2009). SWM studies were carried out at Kolkata (Tumpa *et al.*, 2009) and gave solutions to waste management problems. The study was conducted as the households residing in the Bavanagar municipal area within Kolkata metropolitan city (Ashok *et al.*, 1991). The work evaluated on recycling of solid waste from the capital city of Delhi (Ankit *et al.*, 2008). Recovery of solid waste in economic point of view was done in Bangalore in 1993 and 1994 (Pieter *et al.*, 1994). The study evaluated the environmental quality and physico-chemical characteristics of the landfills at Mathkal dumping ground.

The Solid waste is responsible for our environmental degradation (fire hazards, odor nuisance, atmospheric and water pollution, aesthetic nuisance losses), health problems and economic losses. So it has become a more

challenging issue for the future days. Now, sustainable Solid waste management is necessary to ensure environmental safety and sustainable development in the urban area. The main objective of this study is to examine the types and current amount of wastes generated, assessment of existing solid waste management system and finally suggested a sustainable management system of household solid waste disposal for municipal area.

Materials and Methods

Study area

Dapoli is a Nagar Panchayat in Ratnagiri district, Maharashtra, with a population of 15,713 as per census 2011. The town has an area of 21.57 km² and acts as the main town (Taluka headquarters) for several small surrounding villages (Fig. 1).

Dapoli is famous as a hill station and is also recognized as 'Mini Mahabaleshwar'. It is 215 km from the state capital of Mumbai. Total 100 respondent answers were collected randomly from different wards in the Dapoli area through a defined questionnaire. Field observation and informal discussions also conducted municipality worker, authority and others for knowing the existing management system.

Awareness generation and advertising of scheme

Realizing importance of awareness generation at household level, Nagar Panchayat carried out awareness generation activities through public announcements, displaying banners on public places, conducting ward level meetings with households lacking access to individual toilets, making presentation in schools, advertisements in newspaper etc. Nagar Panchayat called for the active members of the society and NGOs and involved them in

activities of awareness generation. The linkage between open defecation and its ill effects were explained through these IEC activities. As understanding of the issue seeped in, the people's attitude and outlook started changing gradually, and this had an impact on their behaviour. Councilors and other staff members extended door to door awareness about the individual solid waste (Fig. 2). In this study combination methodology such survey, informal discussion and field observation were used in order to accomplish the research's objectives. Observation was done by field walk in order to know the sources of wastes generation, type and dumping sites. Photographs were taken during the observation. Informal discussions were conducted with municipality worker, authority and the inhabitants living adjacent to the dumping sites in order to know the existing waste management system and its limitation.

Results and Discussion

Waste generation and types

Municipal solid waste (MSW), also called Urban Solid Waste, and is a waste type that includes predominantly household waste (domestic waste) with sometimes the addition of commercial wastes, construction and demolition debris, sanitation residue, and waste from streets collected by a municipality within a given area. They are in either solid or semisolid form and generally exclude industrial hazardous wastes. MSW can be broadly categorized into five broad categories as-

Biodegradable waste: food and kitchen waste, green waste (vegetables, flowers, leaves, fruits), paper (can also be recycled).
Recyclable material: paper, glass, bottles, cans, metals, certain plastics, etc.

Inert waste: construction and demolition waste, dirt, rocks, debris. Composite wastes:

waste clothing, Tetra Packs, waste plastics such as toys.

Domestic hazardous waste (also called "household hazardous waste") and toxic waste: medication, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish.

The total quantity of solids waste generation depends on various factors such as geographic location, season of the year, population characteristics, legislation, people's attitude and it also change over time and with development, in the study area. It was found 39% and 29% household produce respectively 2-3 kg and 3-4 kg waste per day and rest of produced 1-2 kg (24% households) and more than 4 kg (8% households) per day (Fig. 3). The majority percentage of solid waste are originated from residential houses these are includes food wastes, metal or non-metal waste, etc.

Study results revealed that 49% organic waste, 19% paper, 14% plastic waste, 6% Metallic, 4% glass waste, 1% wood and 7% others waste produced in the study area (Fig. 4).

Existing system of household waste management

In the municipal area waste collection consists of two parts, in part one household dweller collect their home produced waste, then transfer in the municipality dustbin (temporary storage place) by own willingness. Another part is done by municipality authority such as door-to-door collection and transport the waste to dustbins/containers, by tractor trolley. These solid wastes are collected for removing from the dustbins/containers and transported by open truck then these wastes are disposed in open dumping site.

Table.1 Description of proposed sustainable waste management system

Stage	Name of Stage	Description of Stage
1	Waste generation	These activities in which materials will be known as no longer being of value and will be either thrown away or gathered together for disposal.
2	On site isolation, storage and processing	In this step activity will be associated with the segregation and processing of solid waste at or near the point of generation. For this purpose two types of storage bin will be used..... I. Biodegradable waste storage bin II. Non- biodegradable waste storage bin
3	Collection	In this step two types of collection method will be applied I. Door-to-Door collection by municipality worker II. Self-service by respective household N.B.: One thing should be mind that, two types of waster will be never mixed together during waste collection and bearing.
4	Storage (Temporary storage of collecting waste in a dustbin)	After collection of waste, it will be stored in two separate dustbins. I. Biodegradable waste storage dustbin. II. Non- biodegradable waste storage dustbin.
5	Processing and Recovery	Different types of technique, equipment and facilities will be applied for recovering of usable materials, conversion product. This will be sold in market for processing of industrial raw material.
6	Disposal	In final step waste will be disposed on the basis of its nature I. Biodegradable waste will be transferred in composting site or biogas plant area. II. Non- biodegradable waste will be transferred in low land areas for sanitary landfilling.

Fig.1 Location map of study area

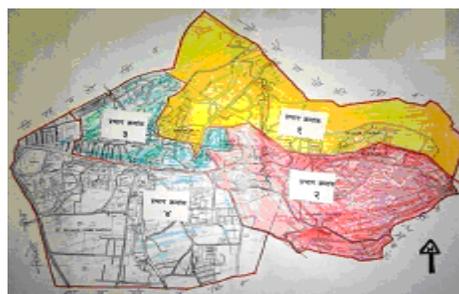
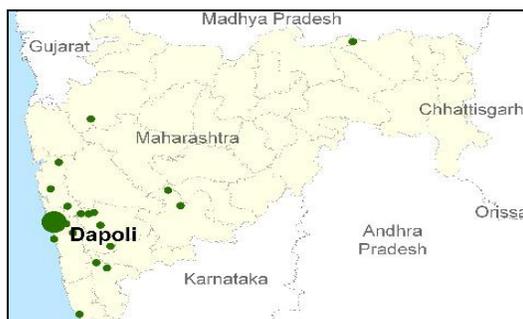


Fig.2 Awareness programme in Community level Awareness programme in a School



Fig.3 Abundances of Solid Wastes

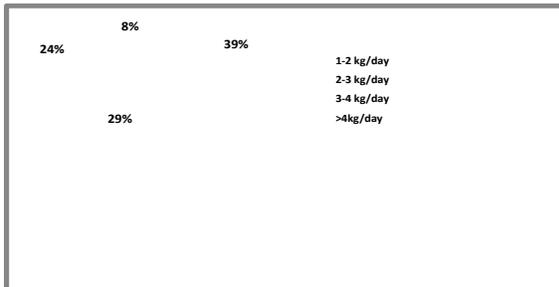


Fig.4 Household Solid Wastes

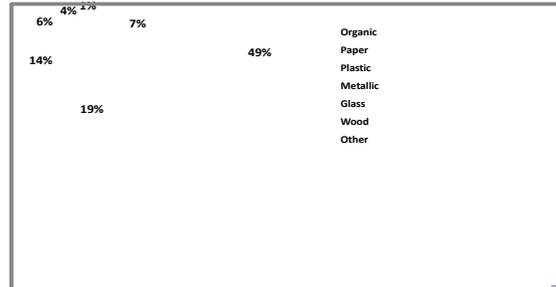


Fig.5 Solid Wastes Storage System

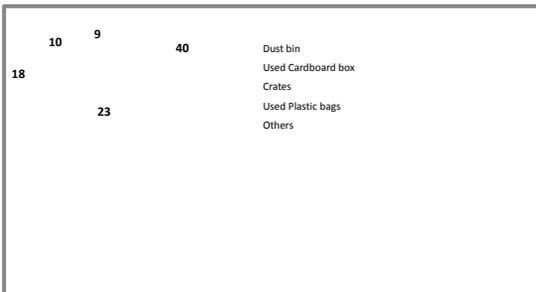


Fig.6 Solid Wastes Disposal

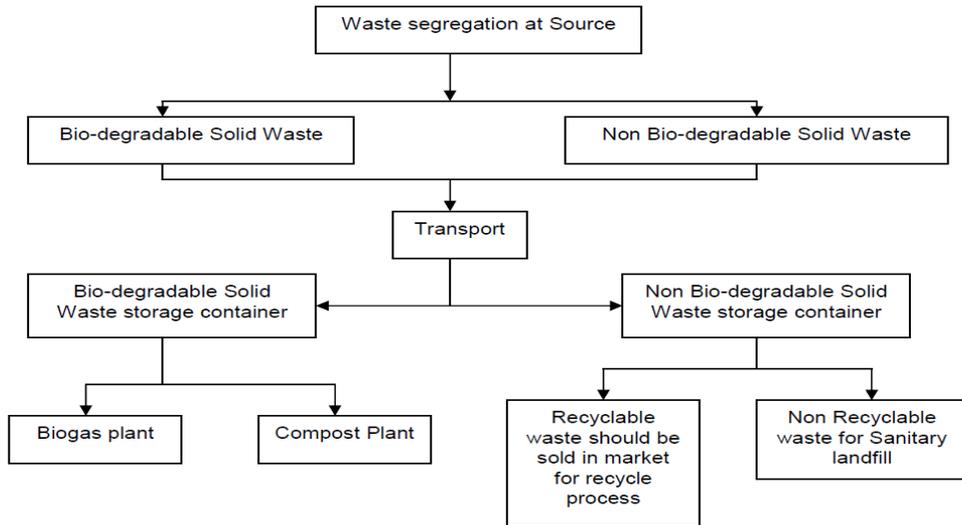
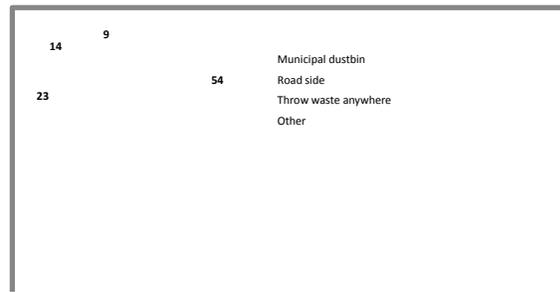


Fig. 6: Proposed sustainable Waste management system

On site handling, segregation and storage

On site handling and storage is an important element of solid waste management. On site handling defined as activities associated with the handling of solid waste until they are placed in containers for storage before collection during on site handling different types of waste are

separated by the waste producer. Separation at source has obvious advantages both in terms of costs and resource recovery. In the municipal area about 68% household never segregate their household waste which not only a problem of waste management but also increase waste management cost and reduce the resource recovery rate.

On site storage of solid waste, facilitates the collection process, collection cost and ensures the maximum collection of solid wastes generated and discourages thrown of waste indiscriminately in the streets. About 40% household used dust bin, 23% used cardboard boxes and 18% used crates, 10% used plastic bags and 9% others (basket, paper bags, etc.) for home produced solid waste storage at home (Fig. 5).

Collection and storage of solid waste

Collection of solid waste in urban area is very difficult and complex task. In Dapoli municipality waste are collected by two steps, in first step households (54%) bring their garbage to the nearby public bins/containers located on the road side. Second part is municipality authorities collect waste (46%) from door-to-door (100%). The primary reason is that the generation of solid waste is a diffuse process that occurs in a variety of places, including individual homes, apartment buildings, etc. With the increase of the quantity of solid waste the collection task becomes even more critical because of the high cost of fuel and labour. It is estimated that 60-80% of the total cost of solid waste management is spend on the collection phase alone on the other hand municipality authority has lower budgets for waste management projects. The For temporary waste storage 54% used municipal dustbin, 23% used road side and 14% to throw waste anywhere and 9% other (Fig. 6). In case of final transformation of waste from temporary storage to disposal site municipality authority suffers various problems. Compactor trucks and farm tractor and trailer various types of vehicle are used for waste collection.

Final disposal

In urban area, for integrating solid waste system disposal site is an important factor and these sites should be safe, reliable for long-term disposal of solid wastes. Mainly low-lying lands areas are filled by urban wastes which are selected by the municipality authority. In the

study area 65% waste is dumped in the lowland open space. Waste spreads all over the site during the blooming of wind its leads to soil pollution, water pollution and air pollution.

Proposed sustainable waste management system

Sustainable solid waste management system includes the generation of waste, storage, collection, transportation, processing and final disposal. This system will be Social sustainability, Environmental sustainability, Economic sustainability. The proposed waste management system also followed above criteria that are discussed in table 1. The proposed new waste management system for Dapoli municipality is present in figure 7.

It is concluded in the study area about 39% households produced 2-3 kg waste per day and majority percentages were organic waste (49%). The present management system in the study area was not satisfactory; about 65% wastes dump in open space. This study has been developed a sustainable waste management system by considering of waste generated, the availability of resources, and the environmental conditions. It will be help for reduction of waste management cost, improvement of environmental quality, resource and energy recovery and finally will improve city living standards.

Though the level of awareness of waste collection services and waste management regulations were relatively high, the percentage of those who used other indiscriminate solid waste disposal methods like open dumping, open burning, and dumping in drainages was higher. It is essential to conduct a long-term awareness rising programme, campaigning and training programme in the area between municipality worker and residences about the sustainable waste management system and its benefit. Educational status, age, gender, cost of waste collection services and the location of residence, among others, were factors influencing solid waste management. This

programme will be successful when municipality authority, Non-government organization and residential community will be working together, as a result they will get a clean and better city for habitant.

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