Urban solid waste management- problem dimensions and alternative solutions

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ABSTRACT
In urban cities, management of solid waste has become a mammoth task for city administrators. With the burgeoning population, rapid urbanisation, massive migration, increased consumerism, throw away lifestyle, apathy of Government and callousness of citizens towards common concern, the issues of solid waste management are bound to become further complicated. Waste Management cannot be anymore perceived as just clearing the rubbish from one place and dumping as waste at some other place. Its implications have multiple consequences on public health, environment, socio-economic development, natural resources, business and aesthetic values of the city. The current practices of waste management in India and most other developing countries are by and large unscientific and unsustainable. There is a desperate need to think beyond conventional approaches with a holistic view rather than piecemeal ambitions. The present paper deals with some of the current aspects in solid waste management and suggests a few alternative solutions.

Key words: Municipal solid waste, Zero waste, Extended producer responsibility

Introduction
In general, the waste is something unwanted for the person who discards it. It is anything, may be a product or a byproduct or a material that does not have value anymore for the person and is therefore thrown away. However, the term “unwanted” is subjective and the waste could have value for some other person in some context or other or in some circumstance or other or in some culture or other. Proper handling of solid waste is the need of the hour because of the sheer quantum of waste and dangerously changing composition of waste and their dire consequences to human health, environment and economy. Further an efficient management of waste can generate wealth out of waste. As generation of waste is difficult to be contained, proper management of its disposal is drawing our attention, and it is nevertheless a Herculean task. Innovative and scientific disposal techniques have to be evolved on an urgent basis for the collective well being all living things in the world, including Mother earth.

Problem dimensions
The nature of waste varies with time as societies develop. Hence the mechanism to handle waste management need to be dynamic; it also has to differ from place to place; therefore the strategies have to be different and comprehensive, with enough sensitivity to place and culture. Many factors affect the composition and characteristics of solid waste and no one method of waste disposal can have universal application and that the need for as divergent practices as possible depending on the requirement. Blind copying of one or other method will not serve any purpose and might complicate the consequences. Dimensions of waste management are now presented.
Population - urbanisation and waste generation

India has witnessed a phenomenal growth in population. It has crossed one billion and is growing at the rate of 2% per annum. At the beginning of the last century, the population was merely 238,396,327. The population in 2001 census was reported as 1,027,015,247, projected to rise by 2016 to 1,263 million. As a result of the burgeoning population, the number of AUs (agglomeration urban) and Towns has been increasing alarmingly. In 1971, there were only 2590 AUs and Towns. In 1981, it grew to 3378, in 1991 to 3768 and it reached 5545 by 2001. For various reasons, there is a high rate of migration from rural areas to urban cities, which resulted in rapid urbanization or urban-slums. The urban slums are really urban-shames, difficult to deal with by any authority. The estimated urban growth rate, i.e., urban population growth rate, is 3.5% per annum. At present, 27.78% of the population lives in urban areas. It is projected to reach 33.5% by 2006 and 36.6% by 2011.

There is a dearth of precise and reliable data on solid waste generated in India. Further there are no agencies, which are involved in collection and documentation of solid waste data on a perpetual basis. However, the literature reviewed by the authors reveals the alarming growth in solid waste generation in the last decade. In October 1994, the leading magazine 'India Today' reported that the total quantum of solid waste generated from the then nine metropolitan cities at 8.3 million metric tonnes per annum. In August 1995, the National Environmental Engineering Research Institute (NEERI) published a Strategy Paper on Solid Waste Management in India reporting the total solid waste generated in India as 23.86 million tonnes per annum. The report published by National Plastic Waste Management Task Force, under Ministry of Environment and Forest in 1997 stated that a total of 80,000 tonnes per day (27.2 million tonnes per annum) of municipal solid waste was produced in the country. In 1998, in a brochure on 'Launching a Clean City Campaign in the States in the 50th Year of Independence', published by Ministry of Urban Affairs and Employment, it was reported that the total solid waste generated in India in a year at 30 million tonnes. The generation of solid waste in India was projected to increase at a rate of 1 to 1.33% annually ('Shekdar 1999'). In 2002, Toxic Links, an NGO published that about 0.1 million tonnes of municipal solid waste is generated in India everyday i.e. approximately 36.5 million tonnes annually. Fig. 1 depicts the quantum of solid waste generated in India in last ten years. There is a direct relationship between population and waste generation and between urban population and waste generation. (Figure 1)

Affluence and accumulation of waste

The per-capita income at current and constant prices in 1993-94 prices for the year 2003-04 was reported as Rs 20,862 and Rs 11,684 respectively. The corresponding values for the previous year were Rs 18,912 and Rs 10,964. The average annual increase in per-capita income at current price and constant price in last ten years ending 2003-04 are approximately 11% and 4% respectively. As cities are becoming main economic centers, the urban affluence is increasing steadily. The World Bank estimates that in the developing world, as much as 80 percent of future economic growth would occur in towns and cities. This trend of growth generally leads to change in the consumption pattern, which not only increases the quantum of solid waste but also shifts the nature of solid waste generated. The Municipal solid waste in India is expected to grow substantially in its organic content and only marginally in non-biodegradable elements except paper. It is projected that the organic waste may go up from 40% to 60%; plastic from 4% to 6%; metals from 1% to 4%; glass from 2% to 3%; while paper may increase substantially from 5% to 15%. Remaining waste like ash, sand grit may decrease from 47% to 12%, as per World Bank reported in its report for FY 2000.

Quantum jump in waste

It is estimated that in India, the waste generation may rise from 40,000 metric tonnes per annum (from April 2004) to over 125,000 metric tonnes by the year 2030 (Toxic Links 2004). The average collection efficiency for municipal solid waste in Indian cities is about 72.5%. Around 70% of the Indian cities lack adequate waste transport capacities. According to Government of India (GOI, 1998) estimate, urban solid waste in India generally contains up to 20% of recyclable matter, whereas the compostable material may constitute around 40-50% and the rest being stones, dust etc.

Dumping of waste

By and large, the waste is disposed by open dumping in the name of landfill disposal without following the principles of sanitary and secured landfilling.
Wastes are carried to city outskirts and deposited in the low-lying areas without testing soil permeability. They remain uncovered and hence exposed, providing conducive climate for breeding flies, rodents and several other insects. The term ‘landfill disposal’ is highly general, vague and subjective. It ranges from uncontrolled open dumps to controlled dumps, engineered landfill and sanitary secured landfill with provision of gas recovery and leachate treatment. The main environmental problem associated with landfill is pollution of ground water and the atmosphere. Studies have shown that the leachate from solid waste may have a pollution load up to 15 to 20 times higher than domestic wastewater.

Composting of waste

In few cities composting of solid waste is being done, but it is carried out in the most unscientific manner. The waste is just dumped into a pit which is partly covered, kept for at least 3-6 months and sold out in a ‘as is where is’ basis at a throw away price. In some places vermin-composting is done in small scales, in fact, the Municipal rules 2000 categorically recommended to compost organic waste of the city. The main concern of composting is the quality of the final output compost, which depends on the quality of segregated organic waste. The unsegregated waste yields poor compost. Ideal waste segregation is still a far cry in the country, but not an impossibility if everyone is sensitized to the issue.

Incineration of waste

Incineration of Municipal Solid Waste (MSW) can theoretically reduce the waste requiring land disposal by up to 75% and volume by up to 90%. But in Indian solid waste, due to high moisture content and low energy content, it is difficult to incinerate. There are concerns regarding the potential human health hazards and ecological effects of polychlorinated biphenyls (PCB’s) and dioxins emitted from MSW incineration. Moreover, incinerators are prohibitively expensive.

Waste recycling

Recycling of municipal waste in India is carried out as an unorganized sector, which consists of waste pickers, itinerant buyers, dealers and wholesalers. It is estimated that in India there are about 65,000 waste-pickers involved in the recycling sector and save about 20% of the municipalities’ budget. Waste pickers collect a substantial quantity of the waste from the streets, municipality bins and landfills. The reduction is between 10 and 15%. Today recycling sector is facing many hurdles like the mixed disposal leading to deterioration in their recyclability, handling of toxic, hazardous and unsafe material, risk of fire accidents, poor product design, lack of market for recycled products. Besides, the waste traders or dealers face the problems of police harassment on the pretext of buying stolen goods and operating the trade in the encroached land.

Alternative solutions

The approach to waste management has to be changed from passive management (concern with final disposal) to an active management of planning and integrating socio-economic and environmental concerns in the whole task of dealing with urban waste. The present waste management system has not solved the problem, rather it is unfolding the hidden cost of waste accumulation and paving for unsustainability. Hence, instead of managing the waste, the time has come to put new insights into elimination of waste. The golden 3-R’s principle of waste management (i.e. Reduce, Re-use and Re-cycle) has to be coupled with new dimensions of 3-E’s (i.e. Efficiency, Economics and Ethics.)

For effective and sound solid waste management system, it is essential to put forward new paradigms, which includes zero waste concept, extended producer responsibility, environmental cost of product, source segregation, legitimization of informal sector etc.

Zero waste

The concept of zero waste is evolving as a promising strategy for solid waste management in future. At present in India, with the existing socio-economic conditions, political negligence and public apathy on solid waste issues, achieving zero waste societies can be a distant dream. But it is necessary for our long-term survival and to avoid future crisis from unmanaged explosive rise in solid waste. Though initiatives and pilot projects have started at few places, it is yet to gain momentum. The zero waste campaigns are being adopted worldwide in many countries. In the USA, zero waste targets have been adopted by Del Norte County, the city of Seattle, Santa Cruz County, San Luis Obispo County and Boulder city, Colorado. The capital city of Australia, Canberra was the first city in the world to adopt zero waste vision of ‘No Waste by 2010’ in 1996. Zero waste
campaigns are also operating in England, Wales, Ireland, Egypt, Philippines etc. There are many International Business companies and corporate worlds following the philosophy of zero waste principles, which includes DuPont Inc, Hewlett-Packard, Toyota, Bell Canada, Kimberley Clark, Ricoh group, IBM, Xerox Corp, Interface carpets and Honda Motor Corp.

Zero waste is a conceptual goal, which aims at elimination rather than managing waste. It is a whole system approach which visualizes that the material flow of production, industrial and economic system are not one way or linear, but represents circular or web-like relationship resulting in no waste. It envisages industries and business to redesign their products and packages to zero-waste, to extend producer responsibility, to end tax subsidies on polluting industries and waste generating activities, to invest in infrastructure which support reuse and recycle than in landfills and incinerators and to create jobs and business from discards.

Ideally, achieving zero waste is impossible, as no system is 100% efficient. However, in the process of achieving the target of zero waste, there can be continuous improvements which can bring dramatic changes in the way the waste is perceived at present. The initiatives such as zero emission, zero defects, zero accidents, smoke free process, 100% CFC free, nuclear free materials, etc are showing good results. The society can be changed, only a beginning has to be made.

To implement zero waste principle, the central government has to initiate the action by forming a nodal agency of zero waste. Sufficient funds should be allocated through the nodal agency and required law should be enacted by legislation. The nodal agency should co-ordinate the networking of local authorities, community associations, recyclers, industries, private sectors, industrial designers and manufacturers in creating vision towards zero waste societies. Universities and colleges should teach zero waste principles as part of their basic curriculum and demonstrate their recycling unit at campus as models and first-hand experience. The general awareness should be promoted in community householders, schools, colleges and offices by preparing modules depicting how changes in behavioral and cultural aspects can influence in establishing zero waste society.

The strategy for achieving zero waste is improving the infrastructure like Resource Recovery Units (RRU), where the potential resources from the waste streams are recovered with appropriate techniques. More number of units should be established, particularly at all the disposal points in the city. These units should be made more accessible, visible and convenient than other disposal options. Database of resource material, which was recovered from waste and network of material exchange, should be created and connected within the city and intercity through electronic system in all RRUs. This will enable and facilitate industries and other potential users to utilize the recovered waste materials.

Extended producer responsibility

The manufacturer's responsibility on the product or goods as per present expectations ends once the product is manufactured and released into the market. The manufacturers do not care for the disposal and its impact after the usage or end of product's life cycle. The buck is passed on to the consumers, who in turn depend on the local government and ultimately the waste gets disposed off unscientifically. To overcome this, wherever possible, the manufacturers should be held responsible for the waste and the environmental impact of their products and packaging rather
than passing that responsibility to the consumer as is being done in the case of Batteries, which was legislated through law (Management and Handling of Battery Rule-2000). This can prompt the manufacturer to look for novel methods in designing and redesigning products, which would involve planning in advance to limit the resource consumption, toxicity and waste. Once the disposal responsibility is vested with the manufacturer, the product will get pruned so as to be compatible to reuse, recycle and recover. By extending the responsibility of the producer, the quantum of dry waste gets substantially reduced and the segregation of domestic household waste becomes relatively easy. The manufacturers can tie up with other external recycling agencies involved in recycling profession, thereby benefiting all the stakeholders. Thus the reverse distribution system can be developed to take back disposed waste into production rather than dumping as landfills or incinerating.

Environmental cost of product

The price of the product is generally calculated based on cost (which includes direct and indirect cost), demand and competition. The environment cost of the product is often ignored which is of late quite significant. The cost associated with extraction of virgin depleting resources, processing which generates air and water pollution, transportation and final disposal of the product thereby which leads to environmental degradation and public health impact expenses are not taken into account. Even while calculating the GDP for the national economy, the cost of degrading environment, depleting forest, dwindling natural resources and non renewable fossil fuels is not taken into account. Thus the price of the product does not reflect the true cost, as the burden on environment is invisible and sometimes non-quantifiable. In the pricing of the product, if the cost of environmental damage caused by that product during manufacturing and disposal is included, then the price of the product will be high. Thus more environmental friendly products can become cheaper and be more in usage causing less threat.

Source separation

The best strategy for effective solid waste management is source separation of dry and wet waste. Atleast 15% of the waste can be conveniently segregated at source for recycling. Merely enacting laws cannot yield any results unless citizens realize themselves and change their mindsets. All that is required is to cultivate the habit of keeping recyclable waste separate from biodegradable food waste. It can be achieved by having 2-bin system for storage of waste at homes, shops and other establishments. This will not only save the national resources but also the cost and efforts of disposing mixed waste. The compost generated from organic waste devoid of inorganic or dry waste will be of high quality and better yield.

iv. Recycling the Recyclable Waste

In Indian scenario of waste management, the term ‘Recyclable Waste’ is often misused and misinterpreted. Theoretically, all recyclable waste can be recycled, but unless recycling is actually done, the term ‘Recycling’ is meaningless. The feasibility of recycling depends on profit opportunities, economic viability and return on investment. From an economic perspective recycling pays only when cost of collecting materials, sorting for recycling and marketing is substantially lower than the value of recycled product. But sometimes, due to unequal subsidies, the costs of recycled product are higher as compared to virgin material based products. To have a successful recycling sector, other issues to be addressed are better product design, toxic level, safety level of materials used, improved working conditions of waste workers, social recognition to workers (as done in Pune) and Government support for adequate infrastructure.

Conclusion

The present approach to SWM considering that it is a responsibility of municipal body, is no good as it ignores several socio-economic aspects of existing solid waste system. The approach does not address the roots of the problem but merely shifting the problem to another environmental medium. Hence, new alternatives are needed to be explored. Instead of pondering on new waste disposal method, we can think of non-generation of waste itself. The aim should be on eliminating the waste rather than managing. The solutions dealt above could avert future crises of solid waste management.

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