On the issue of waste and waste removal in India - An overview of the current status and possible solutions to the problem
Hulladék és hulladék eltávolítás Indiában - A jelen állapot áttekintése és a kérdés lehetséges megoldása

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Abstract: In most Indian cities, open dumping of waste is common practice, with waste pickers working at such sites; people in villages complain about waste from cities being disposed of in rural areas. In addition, there is the further issue of dumping of waste coming with all its side effects on public health and the environment. There are significant risks due to rodents, insects and other vermins attracted to such sites. With garbage dumps often harbouring small areas of water, the breeding of mosquitoes poses another serious issue.

Key words: Waste, waste removal, India, public health, vector-borne diseases, rodents, snakes, water

Összefoglalás: A legtöbb indiai városban a hulladék nyilt helyen történő lerakása általános gyakorlat, az ilyen helyeken megjelenő hulladék gyüjtő emberekkel; a falusi lakósok panszkodnak, hogy a városi hulladékot a vidéki területeken rakják le. Ehhez járulnak a hulladék lerakásnak a közegészségügyre és a környezetre gyakorolt összes mellékhatásai. Jelentős veszélyt jelentenek az ilyen helyekhez csábított rágcsálók, rovarok és más férgek. Gyakran a kis területű vizeket fenntartó hulladék lerakók a moszkitók tenyésztése révén további veszélyt jelentenek.

Kulcsszavak: hulladék, hulladék eltávolítás, India, közegészségügy, vektor terjesztette betegségek, rágcsálók, kígyók, víz.

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Introduction

Each year, around 78 mn tons of waste are produced in India. With 1.2 bn people, a daily amount of 0.2–0.6 kg of waste is added per capita. Economic development, population increase and the growing wealth of many Indians will lead to a further increase in waste production. These huge amounts of waste require concepts for waste removal in order to ensure a smooth functioning of the entire system.

However, the system seems to be overwhelmed by the task. As it was put in an article in the New York Times: "Trash is India's plague. It chokes rivers, scars meadows, contaminates streets and feeds a vast and dangerous ecosystem of rats, mosquitoes, stray dogs, monkeys and pigs.

Waste "tourism" and its consequences

People in villages complain about waste from cities being brought to their villages because the cities' authorities do not know what to do with the waste and how to remove it appropriately. As mentioned in The Times of India: "We have a habit of collecting garbage from cities and dumping them in villages. " An example would be the waste coming from the city of Thiruvananthapuram in Kerala and which is brought to the village of Vilappilsala, whereby the village population protests against this as the waste contaminates rivers, wells and springs.

Fig 1: *House of a garbage collector*

1. ábra: *Egy hulladékgyüjtő háza*

Fig 2: *Urban waste disposal site*

2. ábra: *Városi hulladék lerakó hely*

The Hindu pointed out that "in 2012, for the first time in its history, India saw nationwide public protests from the northernmost Jammu and Kashmir to southernmost Tamil Nadu against improper waste management. ... Since Thiruvananthapuram started transporting its waste to Vilappilsala village in July 2000, respiratory illnesses there have increased tenfold, from an average of 450 cases a month to 5,000. People who regularly swim in the village aquifer have begun contracting infections while swarms of flies have become pervasive. Currently, there is not a single household that has not suffered respiratory illnesses because of the waste processing plant and the adjoining dumpsite." This specific issue has been subject to a number of publications, including one about the perceptions and attitudes of the community towards solid waste management, published already in 2003.

Further strains on the system exist due to the sharp population increase and the associated increase in waste production. In the year 2000, the Indian Government (Ministry of Environment and Forests), set up guidelines how to manage solid waste, including citizens' responsibility to separate waste at source and to avoid littering streets. All cities are required to set up appropriate measures including waste separation in households, recycling as well as composting. However, not a single city has been able to implement these measures. Mountains of rotting waste are standard in each city, with the approach of disposing of city waste into villages being describes as "without conscience" . As mentioned

in The Hindu, “open dumping, open burning, landfill/dumpsite fires, and open human and animal exposure to waste are common”.

Fig.3: *Roadside waste disposal site*

3. ábra: *Útmenti hulladék lerakó hely*

Fig 4: *Burning of waste near a forest*

4. ábra: *Hulladék égetés erdő mellett*

Fig 5: *Urban roadside waste*

5. ábra: *Városi útmenti hulladék*

In most Indian cities, open dumping of waste is common practice, with waste pickers working at such sites. Such open dumping comes with all its side effects on public health (significant risks due to rodents, insects and other vermins attracted to such sites; poisoning and chemical burns resulting from contact with hazardous, chemical waste mixed with general waste; burns and other injuries resulting from occupational accidents and methane gas exposure at waste disposal sites) and the environment (soil and water contamination).

A report by the NGO Centre for Science and Environment (CSE) based on surveys of wastewater profiles of 71 Indian cities, highlights a lack of infrastructure and neglect of sewage. Less than 30 percent of the country's officially recorded sewage is treated in proper facilities, 70-80 percent of India's wastewater ends up in its rivers and lakes with sewage systems leaking and being incomplete. "We are drowning in our excreta," as Sunita Narain, director of CSE, put it. According to the WHO, only one third of Indians in rural areas have access to toilets, compared with 87% in urban areas. The Indian Central Pollution Control Board stated in 2008 that untreated sewage flowing in open drains was causing serious deterioration of groundwater quality.

Fig 6: *Washing dishes and collection of drinking water near waste and wastewater*

6. ábra: *Edénymosás és ivóvízgyüjtés hulladék és szennyvíz közelében*

The issue is not unique to India. In Asia, 1.7 mn tonnes of waste are produced every day. With the above mentioned population increase, this amount is growing. This makes conventional approaches such as waste dumps not sustainable in the future, and new business opportunities for waste management arise.

According to Germany Trade and Invest, India's market size is estimated to be around $8bn per year, with only $500mn realised so far. This again poses challenged for western companies attempting to enter the market since the waste composition is different, as mentioned above.

Waste pickers in India

There is no organised recycling nor waste separation in India; this usually only happens on waste dumps and is done by waste pickers of which there are around 1.5 mn in the country. Waste pickers collect household waste from the roadside as well as commercial and industrial waste as well as litter from streets and urban waterways.

Fig 7: *Rural roadside waste disposal*

7. ábra: *Vidéki utmenti hulladék lerakás*

Millions of people work as waste pickers all over the world, but only little reliable socio-economic or statistical information is available. For India, their numbers is estimated to stand at around 1.5 mn, with the vast majority being women and people from socially marginalised groups.

The role of waste pickers for waste management in India can be seen from the example of the city of Kanpur in Uttar Pradesh where 3.6 mn people live. The city received the award for the Best City for Improvement in Solid Waste Management from the Indian Prime Minister in 2011. The Indian Express highlighted the story as follows:

> "The state of solid waste management in Kanpur was no different from most other Indian cities until only a few years ago... The solid waste generated in the city [was] estimated at about 1500 tonnes per day. There were numerous collection centres in the city, more than 400 of which were open dumps. A fleet of 132 vehicles and 3000 safai karmacharis [people involved in 'unclean occupations'], were supposed to collect and transport the city garbage and dump it at an "authorised" site a few kilometres away from the city. A community of rag-pickers was involved in removing recyclable waste from the waste chain.
>
> One of the largest dhalaos (open temporary dumpsite) has not only been converted to a park, but has become public space for expression of art; 11 art enthusiasts have made beautiful paintings on a wall

which once stood testimony to public apathy towards urban hygiene. Yet another garbage collection centre has been converted into a ward office.

Door-to-door collection of garbage is being done in bins attached to rickshaws by safai mitras using hand gloves and protective masks. The garbage is directly unloaded into refuse compactor trucks of varying capacity, which can typically take the load of 40 to 50 bins. This way the garbage is compressed while being transported and more of it can be accommodated in the vehicle. There are still a few dumpsites on the streets, but they are on their way out. Each transport vehicle is equipped with GPS and every incidence of the compactor halt to collect garbage is monitored and recorded. This minimises the scope for deception and discourages fuel theft.

Rag-pickers have been given the opportunity of starting a new life. ... Some of the former rag-pickers (130, to be precise) now earn a regular salary as safai mitras, sport a bank ATM card, enjoy social security and health benefits, and their young kids have started going to schools.

The garbage is taken to a central site where it is sorted, segregated, transformed into a number of products of value, for example, premium quality compost, RDF, interlocking tiles from construction debris for use in footpath paving, etc. After selling off some other recyclable material, very little (less than 2 per cent or so) remains to be deposited in the landfill. The landfill, which was expected to fill up in seven years, may actually take much longer, thanks to the success in reusing most of the waste.

Sources of waste

According to the National Solid Waste Association of India , the main sources of municipal waste are:

- Household waste
- Commercial waste
- Street sweeping
- Hotels and restaurants
- Clinics and dispensaries
- Construction and demolition
- Horticulture
- Sludge

As reported in The New Indian Express, waste generated by hotels and restaurants in Bangalore, 750 tonnes per day, should not be sent to landfills anymore by 2014, but instead be managed privately: “Bulk generators like hotels, hospitals, malls, community halls, IT parks and industries, which together generate 1,500 tons of waste every day, had committed to manage garbage disposal themselves. In this regard, hoteliers have come forward to manage waste generated by them. ... At present, there are two companies in Bangalore which are disposing bio-medical waste generated from hospitals and nursing homes.” Furthermore,

around 400 tons of wet waste will be sent for bio-composting and penalties for littering offences are contemplated.

As mentioned above, the proportion of organic matter is higher than in Western countries, as shown in the following diagram :

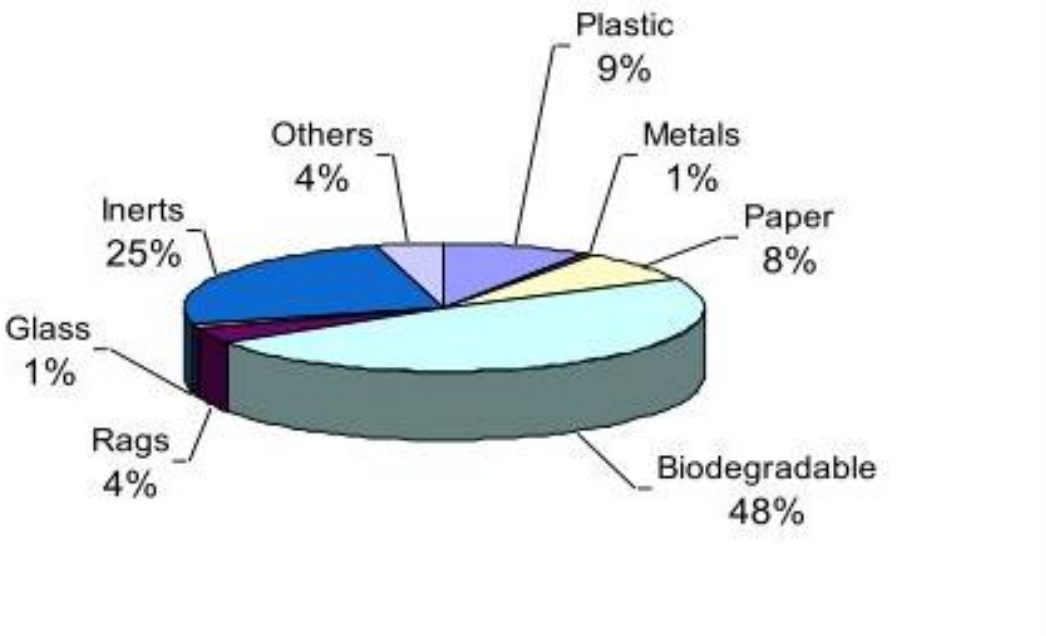

Diagram: *Composition of municipial solid waste in India*

(National Solid Waste Association of India)

As pointed out by NSWAI, the amount of municipal solid waste has been increasing rapidly and its composition changing with rising urbanization and change in lifestyle and food habits. There are different categories of waste generated, each take their own time to degenerate *(as illustrated in the table below).*

The type of litter we generate and the approximate time it takes to degenerate	
Type of litter	Approximate time it takes to degenerate the litter
Organic waste such as vegetable and fruit peels, leftover foodstuff, etc.	A week or two.
Paper	10–30 days
Cotton cloth	2–5 months
Wood	10–15 years
Woolen items	1 year
Tin, aluminium, and other metal items such as cans	100–500 years
Plastic bags	One million years?
Glass bottles	undetermined

As can be seen from the table above, certain types of litter can cause more problems than others when it comes to the time needed for degeneration. Plastic is one such type of waste. In Delhi alone, around 690 tonnes of plastic waste are generated each day, in Chennai this amounts stands at 430 tonnes, in Kolkata at 425 tonnes and in Mumbai at 408 tonnes. The total daily amount of plastic waste for the country stands at 15,342 tonnes, with at least 40% of this plastic waste still not being recycled and thus contributing 275 tonnes of plastic waste in Delhi each day, followed by Chennai and Kolkata at around 170 tonnes daily each as well as Mumbai with 163 tonnes.

The role of animals in waste removal

As mentioned above, dumping of waste comes with all its side effects on public health and the environment. There are significant risks due to rodents, insects and other vermins attracted to such sites. Even though traps and poison tablets are used to eliminate rodents, there is still a significant number that survive and procreate. Rats are known to be vectors for a number of diseases, e.g. lesptospirosis (with an infection rate of up to 80%). Snakes are also attracted to garbage dumps as they feed on them, again posing a risk for people living nearby.

Organic waste removal often happens through animals. The above mentioned New York Times article also points out that "just outside of Bangalore, a growing number of pig farms are picking up food waste from the city's hotels and restaurants." Cows, goats and pigs are a part of the recycling system as are rats, dogs, cats and other animals. This leads to further issues, such as rabies: "Municipal waste on streets and at dumpsites is a significant source of food for stray dogs. Rabies due to stray dog bites is responsible for more than 20,000 deaths in India every year. In Srinagar, 54,000 people were bitten by stray dogs in the last three-and-a-half years.

Fig 8: *Cow feeding on waste*

8. ábra: *Tehén táplálozik a hulladékon*

Fig 9: *Pig feeding on waste next to a bus stop*

9. ábra: *disznó táplálkozik hulladékon busz megálló közelében*

Fig 10: *Dog feeding on roadside waste*

10. ábra: *kutya táplálkozik útmenti hulladékon*

Fig 11: *Donkeys feeding on roadside waste*

11. ábra: *szamarak táplálkoznak útmenti hulladékon*

With garbage dumps often harbouring small areas of water, the breeding of mosquitoes poses another problem, as illustrated in an article in The Hindu: “Kolkata recently experienced an outbreak of a dengue fever with 550 confirmed cases and 60 deaths. This outbreak coincides with a 600 per cent increase in dengue cases in India and a 71 per cent increase in malaria cases in Mumbai in the last five years. Transmission of mosquito-related diseases is caused by non-biodegradable litter, which causes rainwater to stagnate, or clog drains, which in turn create breeding grounds for mosquitoes.”

Possible solutions

Given the fact that the increase of waste generated in urban areas in India is expected to stand at around 5%, environmentally friendly, modern and powerful solutions are the way to go. Numerous western companies offer such solutions and try to enter the Indian market and exhibit e.g. at IFAT India in Mumbai. However, waste in India usually has a different composition form waste in Western countries as mentioned before and this issue poses a serious problem for waste management.

The Indian Ministry of Urban Development published a Guidance Note on Municipal Waste Management on a Regional Basis in which various case studies with possible solutions and approaches are presented, including ones from the USA and New Zealand.

Indian waste is usually not separated. It mainly consists of organic matter that does not burn well, mixed with comparatively little packaging waste which would make incineration easier. Waste in India also has a high component of sludge and other materials that componentof sludge and other materials that damage waste disposal and recycling plants.

Incinerators would be one way to tackle the issue, but due to these problems, are difficult to run. An example is an incinerator in New Delhi which had broken down within one week and which has been out of order for years. In addition to this problem, it appears to be logistically challenging to have incineration plants supplied appropriately to be able to supply sufficient energy to enable “Waste to Energy”. Furthermore, the energy value of waste in India is much lower than in Western countries, as mentioned above.

“In his 2013 Union budget speech, Finance Minister P. Chidambaram, announced support to municipalities that will build waste-to-energy projects. ... Financing of waste management project is not accompanied by adequate education and training of human resources. Importantly, new initiatives undertaken by various municipal officials often fail because of frequent transfers.”

A Working Paper on composting , reducing the need for waste removal and allowing the use of the product for agricultural purposes, as well as one on Strategy and Framework of Municipal Waste Management were issued by the Centre for Environment and Development.

Open burning of waste is one of the largest sources of air pollution in Indian cities. “In Mumbai, it is the cause of about 20 per cent of air pollution (particulate matter, carbon monoxide and hydrocarbons). Trash fires also emit 10,000 gram TEQ (toxic equivalents) of carcinogenic dioxins/furans every year in Mumbai alone.” Furthermore, open burning leads to uncontrolled and repeated fires of such garbage dumps, an example of which was reported in The Hindu as “where thick smog created by the raging fire caused severe choking”.

India generates around 400,000 tonnes of electronic waste per year, with an estimated increase of 10-15% p.a., compared with the 5% annual increase of general waste generation. In order to curb additional electronic waste, manufacturers are required to collect computers, handsets as well as white goods for recycling. Nokia has more than 1,400 centres for collection for end-of-life products; Dell has introduced a coupon system for old batteries and computers. However, it is not clear if this guideline will be followed as consumers might pass these goods to their waste collectors, an informal chain that dominates e-waste collection.

Being the fastest growing type of waste and subject to informal waste collectors also means that there will be more and more negative impacts on the environment as environmental standards cannot be met this way. Hence, a number of recycling companies, that are able to meet the existing environmental standards, have been set up in e.g. Delhi, Mumbai and Bangalore within a short span of time.

The issue of appropriate disposal of biomedical waste covers bio-degradable and non-bio-degradable waste. It is estimated that 1-2 kg of waste are generated per day per bed in hospitals India and around 600 grams per day per bed at a GP’s clinic. Biomedical waste is defined as waste generated during the diagnosis, treatment or immunization of humans or animals, or in research activities. The Biomedical Waste Rules were published in 1998 and cover people who generate, collect, receive, store, transport, treat, dispose of or handle biomedical waste.

Summary

In an overview and description of the current situation of India’s waste problem, various aspects were summarized. It is of paramount importance to find solutions that meet local requirements and conditions and that subsequently can be adapted and implemented. It is therefore difficult to engage with proposed solutions from the outside to the internal problems of a country because of differences in mentality and also differing views of the respective parts of the populations.

Waste management offers numerous business opportunities in a globalised world with companies from all corners of the world trying to enter overseas markets. However, the

concepts of waste reduction, waste separation and recycling need to be introduced to create awareness within the population. This requires an understanding that this will not only take time but also depends on the population's mentality and understanding of what serious problems unmanaged waste may cause. The individual types of waste, such as organic waste, glass, paper, packaging, food waste, metal waste and textiles and the efforts to recycle, waste pickers play an important role.

The transfer of knowledge and the introduction of state-of-the-art technology is not always working in waste management. An example of problems of incinerators and waste-to-energy approaches was given as the composition of waste is different in India from Western countries, which makes Western technology not necessarily useable in an Indian context.

The current situation of waste management in India can only serve as a springboard for new solutions; simultaneously, the sustainability of new laws in the area of waste management needs to be ensured with extensive education campaigns.

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