

Report Part Title: PLASTIC WASTE MANAGEMENT

Report Title: WASTE-WISE CITIES

Report Subtitle: Best practices in municipal solid waste management

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4 PLASTIC WASTE MANAGEMENT

Over the last few decades, plastics have become an integral part of our lives because they are cheap, lightweight, durable and versatile.

Unfortunately, these properties have also turned the wonder substance into a major waste management challenge. Plastic is choking our water systems and landfills and its proper management is essential to protect our environment from irreversible degradation.

Reducing the use of plastic through fines, bans and awareness programmes is as important as efficiently recycling the plastic that is used. Plastic that cannot be recycled can be turned into refuse-derived fuel to be used in cement kilns.

Bicholim: Focussed on managing non-biodegradable waste and continuing to act proactively to reduce the impact of plastics on the environment and human health.

Gangtok: Has adopted a strategy of banning to minimise the environmental and health hazard of plastic waste pollution.

Kumbakonam: Quickly followed a state-wide ban on use of plastics in 2019 by setting up a resource recovery facility where non-recyclable plastic is converted to refuse-derived fuel and channelised to cement factories for co-processing.

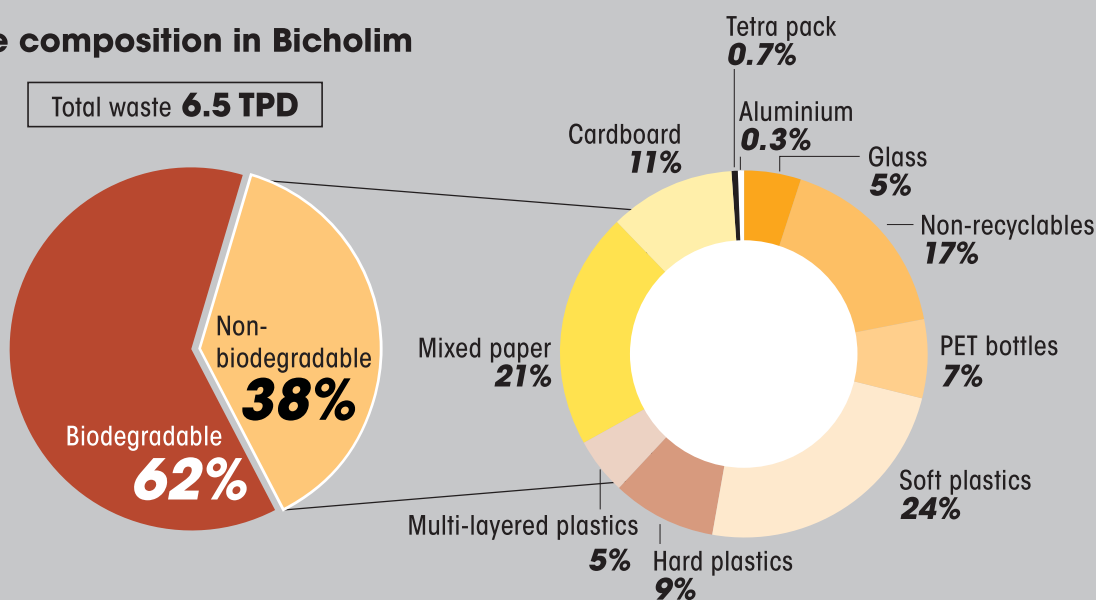
BICHOLIM

Bicholim optimises source segregation and material recovery to manage its plastic waste



Bicholim, also known as Divchal or Dicholi, is a semi-urban town located in the North Goa district, Goa. It generates about 6.5 tonne of waste daily (348 g per person per day). What sets Bicholim apart from other similar towns and cities of the country is the efficiency with which Bicholim Municipal Corporation (BMC) is ensuring material recovery from segregated waste. Bicholim shows us that the the best way to manage plastic waste is to optimise the entire waste management chain.

Waste composition in Bicholim



Source: Goa Waste Management Corporation and Bicholim Municipal Corporation

	Population (as per 2011 Census)	16,986
	Estimated current population	18,700
	Estimated floating population (daily)	1,000
	Area (sq km)	14.47
	Number of households (2021)	4,376
	Number of wards	14
	Number of zones	2
	Municipal solid waste generation (in tonne per day or TPD, excluding C&D waste and inerts)	6.5
	Number of sanitation workers	43
	Number of community bins	0*
	Number of garbage-vulnerable points	0*
	Waste management vehicle fleet size	10
	Percentage of households covered under door-to-door waste collection	100
	Percentage of households segregating waste	95
	Percentage of waste processed	100

* According to the Swachh Survekshan ranking (Star Rating for Garbage-Free Cities) parameter, zero community bins and zero garbage-vulnerable points are strong indicators of an efficient solid waste management system.

Source: Bicholim Municipal Corporation

THE TRANSFORMATION

Bicholim Municipal Corporation (BMC) used to collect unsegregated waste, which was brought to the dumpsite at Lakherem. After maturing, the treated waste would be fed into a mechanical sorting machine to separate inert material from compost. But this method was inefficient, and the non-biodegradable component inevitably contained some biodegradable residue, which meant that it could not be processed and had to be dumped at the site. Due to this practice, Goa Waste Management Corporation (GWMC) dump became over 3,000 m³ in size.

The first positive steps were taken as early as 2005 when the BMC started door-to-door waste collection. But it was only after the Monitoring cum Working committee (McWc) was formed by the Government of Goa (in 2011) to aid urban local bodies (ULBs) and other local bodies with technical guidance that BMC started paying attention to segregation of waste at source.

In 2015, the non-biodegradable waste components started being baled in machines, to be disposed of at cement factories for co-processing, with assistance of McWc. But not much non-biodegradable waste could be recovered since the BMC had not yet achieved proper waste segregation at the source.

From 2016, when the Solid Waste Management Rules came into force, the BMC started actively addressing this issue by conducting awareness camps about the necessity of segregation. BMC began sorting non-biodegradable waste into various categories to enhance sustainable plastic and other non-biodegradable waste management practices. Finally, in January 2019, the BMC ventured into a Memorandum of Understanding (MoU) with the GWMC for five years to set up a material recovery facility (MRF) at the existing dumpsite. BMC has allotted part of its land free-of-cost for operating this MRF for sorting and managing plastic waste. It is after this final step that Bicholim has been able to recycle or process all of its non-biodegradable waste, including plastic, and achieve 100 per cent material recovery, which means that pressure on the dumpsite has been reduced, resulting in health and environmental benefits to the city.

HOW THE SYSTEM WORKS

Within its jurisdiction, BMC collects non-biodegradable waste in designated collection vehicles, while the GWMC collects non-biodegradable waste from neighbouring panchayats, institutions and bulk waste generators. Both BMC and GWMC bring waste to the MRF for sorting into 13 categories, including four different kinds of plastic.

The MRF is operated by Sampurn(e)arth Environment Solutions and United Nations Development Programme (UNDP), under the supervision and with the support of BMC and GWMC.

Infrastructure and machinery at the MRF

- Sorting platform with a conveyor belt
- Forklift
- Two baling machines

Proposed machinery

- Aglo-mixture lump making machine
- Shredders for plastic and glass
- High air blower machines



Material recovery facility at Bicholim

Waste management process in Bicholim



1. Collection of segregated waste at source



2. Non-biodegradable waste collection vehicle



3. Primary sorting at the conveyor belt



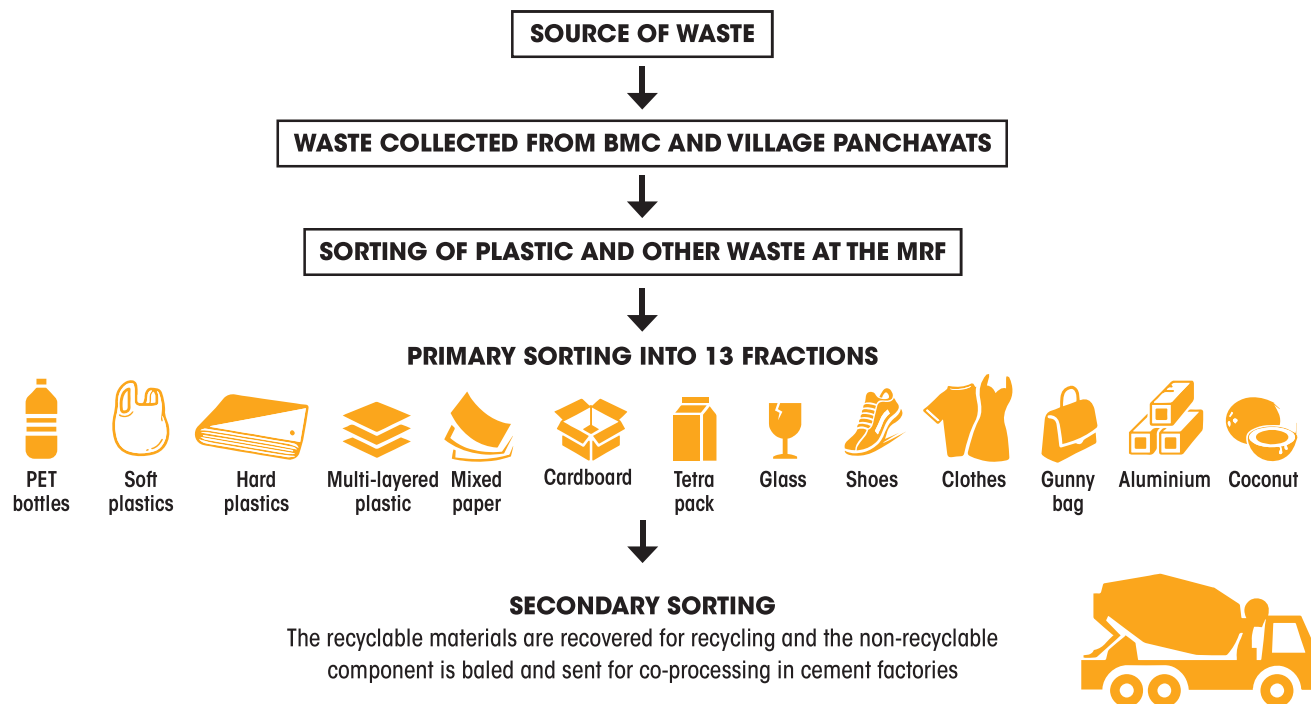
4. Secondary sorting of waste



5. Baling machine at the site



6. Baled waste



●●● PLASTIC WASTE MANAGEMENT

Non-biodegradable waste brought to the facility is first segregated on a moving conveyor belt. The waste is further segregated into recyclables and non-recyclables. The recyclable components, including plastic, is sold to vendors registered with the state Pollution Control Board. The non-recyclable component is baled and sent for co-processing as refuse-derived fuel (RDF) to authorised cement factories.

Fines

The BMC has also started imposing fines on users and vendors found using plastic bags of size less than 50 microns. This initiative commenced in September 2020. Fines are collected on a monthly basis. Raids are carried out by the municipal inspector randomly. The inspector issues *challans* to the violators and the fine amount is collected in cash. The revenue collected is used for solid waste management. BMC aims to completely phase out single-use plastics. The city government is also planning to implement new norms to increase the minimum thickness of plastic bags to 120 microns as envisaged in the 2021 plastic waste management rule notification.

WHAT HAS WORKED

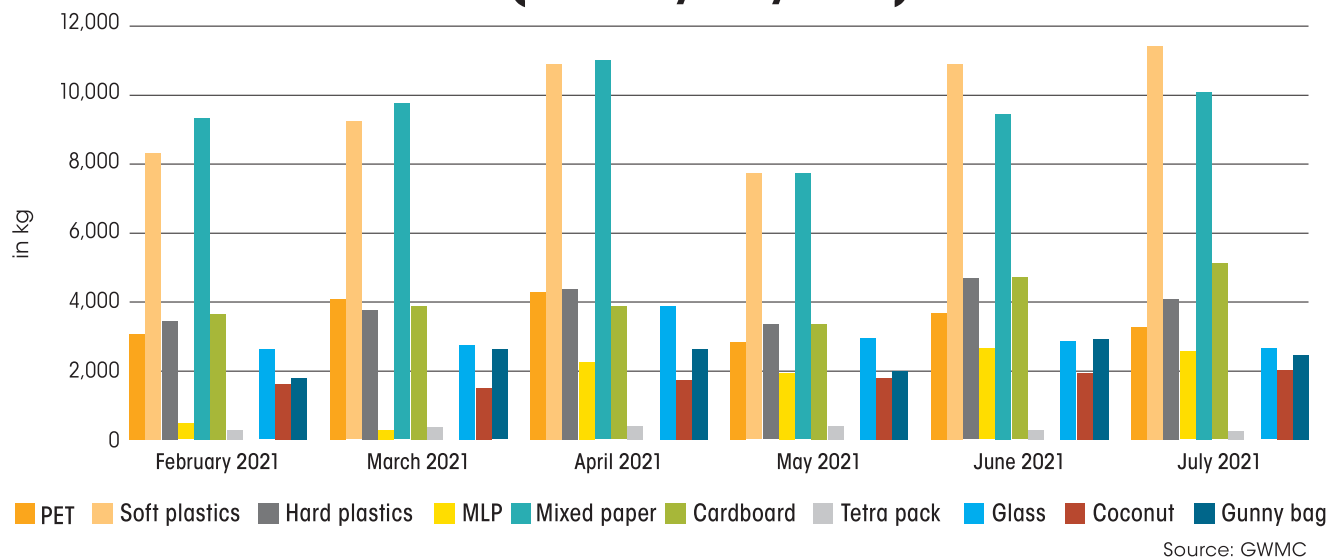
BMC has mainly focused on managing non-biodegradable waste (with an emphasis on segregation at source) and continues to act proactively to reduce the impact of plastics and other non-biodegradable waste on the environment and on human health.

Since the MRF is entirely operated by Sampurn(e)arth Environment Solutions, there are no financial implications for the BMC. Apart from the transportation cost of the non-biodegradable waste to the MRF, BMC does not have any financial liabilities.

Most of the material recovered from the MRF is sent for recycling or scientific disposal. Sampurn(e)arth Environment Solutions generates enough revenue to pay staff salaries (most of the staff is local) and meet other expenses incurred at the facility.

One of the key features of this model is that the BMC, contrary to the concept of 'not in my backyard', accepts non-biodegradable waste from neighbouring local bodies. Due to this, it has effectively treated non-biodegradable waste generated in the entire Bicholim

Quantum of waste sorted (February–July 2021)



Impacts

- Bicholim Municipal Corporation is one of the few urban local bodies that has managed 100 per cent material recovery by recycling or processing all of its plastic waste.
- The contamination of recyclable fractions has been reduced.
- The need for a new landfill has been eliminated.
- Negligible amount of non-biodegradable waste is sent to landfills.
- Many women are engaged at the material recovery facility, thereby contributing to the objective of women's empowerment through employment generation.

Taluka. This means that plastic waste is not an environmental threat in Bicholim any longer.

LESSONS LEARNT

- **Waste can create value:** Plastic waste management can be valuable to the community. In Bicholim, Sampurn(e)arth has made the project economically viable by increasing revenue generation with improved collection, segregation and disposal, and by prioritising valuable items when recycling waste. Since the staff is mostly local, their salaries are plied back into the local economy as well.
- **Generation of livelihood:** Many scrap vendors and others in the informal sector get an opportunity to be associated with the urban local body in terms of trading. Many direct job opportunities can also be created by setting up waste management facilities which hire locals.
- **Outsourcing can help:** The MRF is operated by Sampurn(e)arth Environment Solutions and UNDP. Through this outsourcing arrangement, BMC saves both time and money as it does not have to concern itself with processing and recovering waste.
- **Plastic waste management:** The best way to deal with plastic is to optimise segregation of waste. The more fractions plastic is sorted into, the better the results are from a waste management perspective.

REPLICABILITY

Plastic waste is a common problem across India. In this context, Bicholim stands out for the effectiveness with which it has dealt with its plastic waste. Some salient features of Bicholim's waste management system are segregation of waste into multiple fractions and outsourcing of its material recovery facility. The model used by Bicholim is so replicable that GWMC has already successfully adopted it in 191 village panchayats across Goa. It is the need of the hour for other cities, towns and villages to learn from Bicholim in order to improve their own plastic waste management systems.

GANGTOK

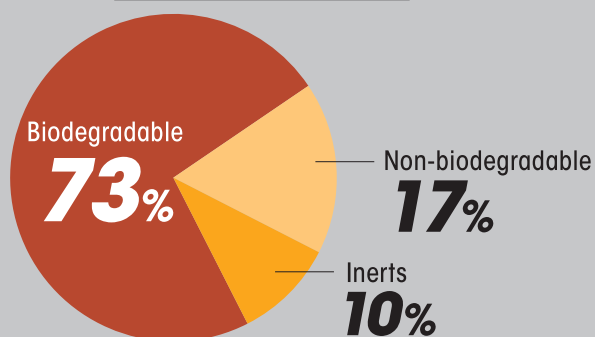
Gangtok has managed to eliminate the menace of single-use plastic by involving the community through awareness programmes



Gangtok, which means 'top of the hill', is the main centre of Sikkim's tourism industry. The city generates nearly 50 tonne of waste per day (192 g per person per day). Despite being visited by lakhs of tourists every year, Gangtok has managed to become a plastic-free city due to the active role played by the Government of Sikkim and the Gangtok Municipal Corporation (GMC). They have imposed fines on offenders and conducted awareness programmes across all segments of the society to make sure the plastic ban is implemented and that it sticks.

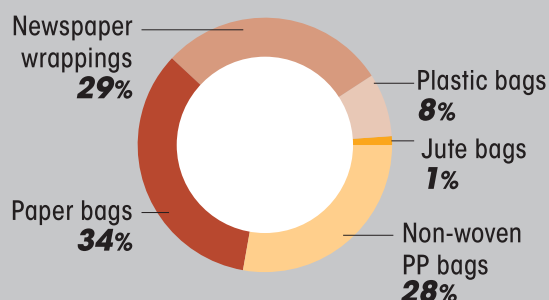
Waste composition in Gangtok

Total waste **50 TPD**



Source: Gangtok Municipal Corporation

Types of carry bags used in Gangtok



Source: Gangtok Municipal Corporation;
Study conducted by Toxics links (2014)



Population (in million, as per 2011 Census)

0.10



Estimated current population (in million)

0.26



Estimated floating population (daily)

2,400



Area (sq km)

19.05



Number of households (2021)

22,255



Number of wards

19



Number of zones

0



Municipal solid waste generation

(in tonne per day or TPD, excluding C&D waste and inerts)

50



Number of sanitation workers

226



Number of community bins

0*



Number of garbage-vulnerable points

0*



Waste management vehicle fleet size

30



Percentage of households covered under door-to-door waste collection

90



Percentage of households segregating waste

80



Percentage of waste processed

63

* According to the Swachh Survekshan ranking (Star Rating for Garbage-Free Cities) parameter, zero community bins and zero garbage-vulnerable points are strong indicators of an efficient solid waste management system.

Source: Gangtok Municipal Corporation

THE TRANSFORMATION

Increasing population, urbanisation and tourism led to increased waste generation in Gangtok but this waste was not properly managed. This led to garbage accumulation in water bodies, open drains, open areas and roadsides. The problems were only exacerbated in the early 1980s when the use of plastic bags became popular. By the mid-1980s, plastic bags were used for everything. During the 1990s, blockages in drains due to accumulation of plastic waste caused landslides in the city.

Gangtok is a hilly area with paucity of land for landfills and other waste management facilities. Therefore, an alternate strategy had to be adopted to minimise the environmental and health hazards of plastic waste pollution in the city. Sikkim had already become the first Indian state to ban disposable plastic bags in June 1998. In 2016, Gangtok went a step further and banned the use of packaged drinking water in government offices and at government events, and thermocol plates and cutlery.

The ban was effective because Gangtok Municipal Corporation (GMC) followed it up with awareness and enforcement activities on the ground. Awareness programmes were held in schools and colleges, and with resident welfare associations (RWAs) and market associations. Taxi drivers were trained to make tourists aware of the need to eschew the use of plastic, and bin bags were provided with vehicles to reduce littering. Sanitation staff was trained in dustbin distribution and source segregation by the GMC. Residents were able to understand the negative impact of plastic waste on their city. They readily contributed to curbing the use of plastic.

HOW THE SYSTEM WORKS

Gangtok engages nearly 226 sanitary workers for solid waste management and 30 vehicles for waste collection and transportation. As the city has very narrow internal roads and some houses are not directly connected to streets because of the hilly terrain, door-to-door collection is done by 120 sanitary workers with the help of push carts.

Segregated waste is collected in 15 out of the 19 wards. Waste collected from residential and commercial establishments and street sweeping is accumulated at 38 intermediate collection points. Currently, 80 per

cent of the waste is segregated at source into two fractions – biodegradable and non-biodegradable. Transportation of waste from intermediate collection points is done in 20 dumper placers and three compactors. The city is in the process of redesigning its garbage collection vehicles to optimise the benefits of source segregation. Vehicles will have separate compartments to transport different fractions of waste.

Gangtok has installed a waste processing plant of 50 TPD capacity at Martam, situated about 20 kilometers from Gangtok. Waste is segregated on the tipping floor. Trommels are used for screening of waste, and segregated waste is transported through conveyor belts and stored separately. Nearly 28 TPD of biodegradable waste is converted into compost which is sold to tea gardens at Rs 7-8 per kg. About 3.4 TPD of recyclable waste is recovered manually and sent to recyclers for various gainful applications. Inerts are disposed of in the dumpsite. The city is in the process of installing a material recovery facility to increase its ability to recover more recyclable fractions.

Fines

Around 1,500 offenders have been penalised under the state plastic ban in the last few years. Total fine collected is about Rs 5 lakh.

- Individual households violating the plastic ban are fined Rs 500
- Commercial establishments violating the plastic ban are fined Rs 2,000–5,000

WHAT HAS WORKED

GMC imposed a ban on single-use plastic very early on. It backed up the ban with fines and awareness programmes on the ground which made people understand the importance of participating in pollution reduction programmes in their city. GMC took the lead by banning packaged drinking water and thermocol plates and cutlery in government offices and at government events, thus setting a good example for citizens to follow. The city received adequate support from the government to create necessary waste management infrastructure (even such simple things as providing bin bags to taxis) to reduce pollution.

By selling recyclables and collecting user fees, GMC is generating a revenue of Rs 52.75 lakh per month. Further, the economic and environmental cost of managing the landfill has considerably decreased as significantly lesser waste is ending up in the landfill.

The findings of a survey conducted by an NGO, Toxic Links, in 2014 revealed that non-woven polypropylene (PP) bags have largely replaced traditional plastic carry bags in Gangtok. This material was increasingly used by restaurants, bakeries, clothing and hardware shops, and branded establishments as well as leading apparel brands.

Similarly, brown paper bags and newspapers were being used to a large extent by grocery stores, fruit and vegetable vendors, sweets shops, and chemists. Hotels and restaurants were also using aluminium packaging for take-away dishes, branded shops were using either paper bags and paper cartons or PP bags, and, in some cases, biodegradable bags. Fast food joints and restaurants have been multiplying in the state due to the boom in tourism. These joints and restaurants were found to be using non-biodegradable plates made of thermocol or metallised paper for serving drinks and food. Some used machine-manufactured leaf plates and bowls with an inner plastic lining.

LESSONS LEARNT

Thirty-two states and Union territories in India have some kind of ban on disposable plastic bags in effect, but it is ignored by residents and citizens because enforcement is not up to the mark and needs to be strengthened. The plastic ban worked in Gangtok because of a few reasons:

Active involvement of citizens: GMC took the task of creating awareness on the ground very seriously and engaged citizens through active participation. From workshops in schools to campaigns to enrol taxi drivers, GMC did all that was necessary to make the citizens of Gangtok understand the problem and care about solving it.

Setting an example: The government showed its commitment to tackle the problem by imposing bans on itself. It did not just go preaching to the citizens but went to them as a committed change-maker itself. Seeing the government make sacrifices for the sake of the city, citizens were naturally inspired to do their part.

Clarity and focus: Gangtok focused single-mindedly on reducing single-use plastic in order to deal with the present and clear danger of landslides. The municipality was clear about what it wanted to do and went about doing it instead of getting distracted.

Impacts

- Gangtok has almost rid itself of single-use plastic.
- The city has been able to replace plastic bags with paper or cloth bags and even with leaves.
- Most shoppers come to the vegetable market with cloth bags for their purchases, and shops use paper bags or leaves for packaging.
- These initiatives have resulted in huge savings in processing and disposal cost of waste and also reduced the amount of land needed to dispose of waste.

REPLICABILITY

Numerous environmental and health hazards are associated with plastic pollution. They increase manifold if the region is eco-sensitive. Other hilly states like Uttarakhand, Himachal Pradesh and states in the Brahmaputra basin (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura) may learn from Sikkim and ban single-use plastic to minimise plastic pollution. Sikkim was the first state to ban single-use plastic, but the city authorities made the ban effective by continuous ground-level efforts. By involving students, residents, shopkeepers, taxi drivers, tourist guides, and tourist authorities, the city successfully eliminated single-use plastics.

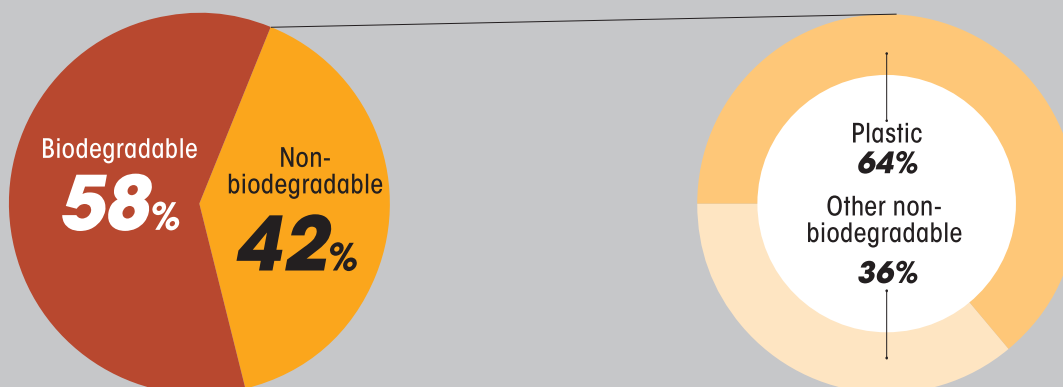
KUMBAKONAM

The temple town converts non-recyclable portion of plastic waste into refuse-derived fuel for cement factories and recycles the rest



Kumbakonam is a special grade municipality situated in the Thanjavur district of Tamil Nadu. The temple town generates 72 tonne of waste every day (511 g per person per day). It has set an example for tier-2 cities of India by effectively managing both its legacy plastic waste (recovered from the Karikulam dumpsite) and new plastic waste, produced mostly by its thriving food industry (that caters to the high influx of tourists).

Waste composition in Kumbakonam



Source: Kumbakonam Municipality



Population (in million, as per 2011 Census)

0.14



Estimated current population (in million)

0.14



Estimated floating population (daily)

25,000



Area (sq km)

12.58



Number of households (2021)

36,105



Number of wards

45



Number of zones

12



Municipal solid waste generation

(in tonne per day or TPD, excluding C&D waste and inerts)

72



Number of sanitation workers

390



Number of community bins

4*



Number of garbage vulnerable points

17*



Waste management vehicle fleet size

18



Percentage of households covered under door-to-door waste collection

100



Percentage of households segregating waste

65-70



Percentage of waste processed

60

* According to the Swachh Survekshan ranking (Star Rating for Garbage-Free Cities) parameter, zero community bins and zero garbage vulnerable points are strong indicators of an efficient solid waste management system.

Source: Kumbakonam Municipality

THE TRANSFORMATION

Kumbakonam is a tourism hub and host to mega-religious events such as *Magamagam* and *Masimagam*. It receives a daily floating population of 25,000, which has led to the development of a flourishing catering industry in the city. Food waste was a major problem in the town, and the 167 dustbins set up to collect it used to overflow frequently, attracting all manner of pests and scavengers. In plastics, the city's food outlets had found a cheap and convenient packaging material. This created a major problem of non-recyclable plastic waste. Moreover, purchasing temple ware from Kumbakonam is considered auspicious by tourists and is the reason for the city's booming copper and temple architecture industries. Waste copper was a worry too.

Stormwater drains in Kumbakonam used to be blocked by a wide variety of plastic waste – straws, thermocol and covers – and led to inundation during rains. Unsegregated waste at the city's landfill at Karikulam rose twenty feet above the ground, spreading over 7.5 acres of the 10.5 acres of the dumpsite area. Biodegradable and plastic waste from restaurants and metal waste from the copper industry occupied a major part of the landfill, with small quantities of e-waste, garden waste and used clothes also thrown in.

In 2015, when the city administration removed dustbins from the city to promote door-to-door collection, people began to resort to dumping waste on street corners. The biggest problem remained the ever-increasing quantity of plastic waste, mostly of the non-recyclable variety (16 TPD), but also a sizeable quantity of recyclable plastic (2 TPD). Since it was mixed with other wastes, there were no takers for it.

In the same year, inspired by the success story of a zero waste ward in the Coimbatore municipality, a team of Kumbakonam Municipality's health department conceived 'Project Sarvam'. Segregation at source had already been mandated. It was also recognised as the most important step to create a plastic-waste free city. So volunteers from Exnora (a non-governmental environmental service organisation), officials of the Kumbakonam Municipality and the city's waste warriors worked as a team to promote the practice under the project. Eleven animators and two supervisors were hired under the Swachh Bharat Mission to sensitise citizens about the

necessity of source segregation of waste. The interlink between a clean city and flourishing business was reiterated among citizens.

Volunteers would draw *kolams* (floor drawings with cultural and religious significance made from coloured flour) at garbage vulnerable points to stop people from dumping waste. City councillors roped in local sponsors from well-off families to finance the practice of awarding households that segregate waste a gold coin every year. At the neighbourhood level, volunteers play a key role by educating children in government schools, and priests and street vendors outside temples; and communicating regularly with citizens through WhatsApp groups on best waste management practices. About 10,000 women working with self-help groups and children have been taught better waste management. Back-to-back awareness campaigns were also run in six wards. In time, reluctance among citizens to segregate waste faded away.

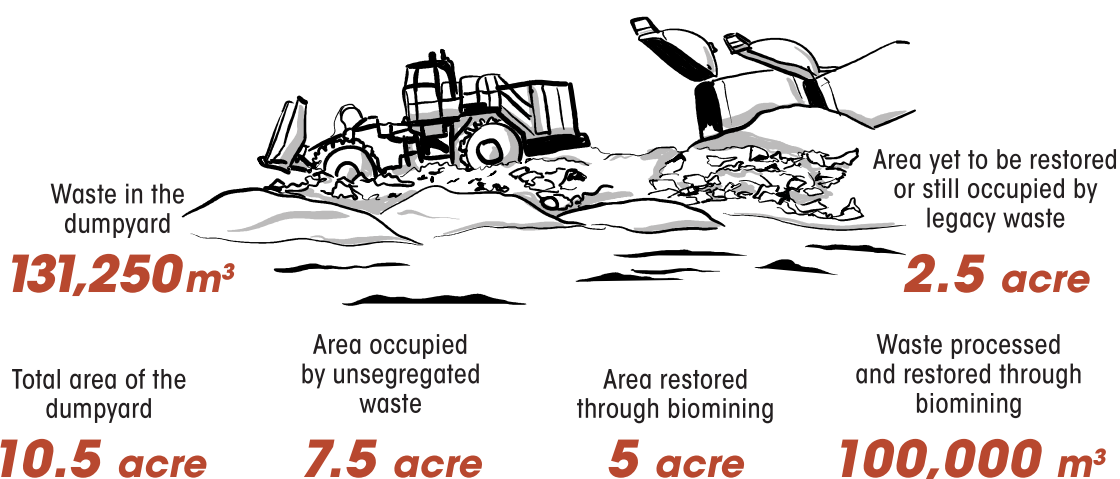
Simultaneously, Kumbakonam Municipality roped in Zigma Global Environ Solutions Pvt Ltd to reclaim the dumpsite (see Box: *A sorry site no more*). A resource recovery facility was set up on the land recovered at the dumpsite.

COVID-19 has brought these endeavours to a grinding halt, with source segregation stagnating at 65–70 per cent, but the municipality plans to pick up things from where it left them once the situation improves.

A sorry site no more

Zigma Global Environ Solutions Pvt Ltd won the tender to reclaim the Karikulam dumpsite on the strength of their proposal of biomining. A mobile municipal solid waste plant was used to segregate legacy waste into 14 different aggregates. Recovered non-biodegradable waste was sent to cement and agarbatti factories, and recyclers. Zigma Solutions bore the transport charges, even paying the factories Rs 500 per tonne to process the waste. At the cement factories, shredded plastic was converted into refuse-derived fuel.

Zigma Solutions has also trained a local contractor, Madurai Meenakshi Solid Waste Clearing Agency, to continue the journey of responsible waste disposal. The waste clearing agency has teamed up with Kumbakonam Municipality on a contract basis to process and recycle waste.



Source: Kumbakonam Municipality

HOW THE SYSTEM WORKS

Once segregation fell in place, the municipality tapped into the backyard space available with most households to set up micro-composting centres to process biodegradable waste, largely food waste, even bearing the cost of digging the compost pits. Larger onsite composting centres were set up in parks and markets, and at bus stops, etc. The funds for these centres are provided by the state Municipal Administration and Water Supply department.

In order to achieve the goal of garbage-free streets, Kumbakonam Municipality mandated a fine ranging between Rs 10 and Rs 1,000 on littering. However, due to political pressure, the fine was later withdrawn. In its place, the municipality deploys workers at garbage vulnerable points, to educate people on, and dissuade them from, littering.

Architecturally, a space of at least five feet is left between houses in Kumbakonam for ventilation and to accommodate sewage channels. But these spaces had been turned into garbage dumping sites. In order to clean them up, the municipality zeroed in on donors to contribute to the novel initiative of planting saplings. Citizens began to keep these spaces spotless to reap the benefits of fruit- or vegetable-giving plants.

In 2016, a biomethanation plant was set up at the cost of Rs 5 lakh, paid for by bulk waste generators, while the land was provided by the municipality. The plant employs 20 workers and has a capacity to process 10 tonne of food and garden waste daily. The municipality has entrusted the responsibility of food waste collection on hotel associations, who are bulk waste generators. Kumbakonam Municipality processes 40–42 tonne of biodegradable waste per day through five micro-composting centres and 34 onsite composting centres (producing compost) and the biomethanation plant (producing biogas).

Domestic hazardous waste (e.g., tubelights), with no reusable value, is sent to factories to be destroyed. Vehicle tyres and water bottles are sent to traders in Kumbakonam and Chennai for reuse. Garden waste (e.g., coconut shells) is sent to a factory in Erode that uses it to make mosquito repellents.



Kumbakonam waste management initiatives A timeline

2014

Door-to-door waste collection

2015

Segregation at source (two-way segregation)*

Reclamation of dumpsite started

2017

Year of notification of solid waste management bye-laws

2018

65–70 per cent source segregation achieved

2019

Ban on plastic following the state government's order

Setting up of resource recovery facility

Refuse-derived fuel plastic to cement factories**

2019

Completion of dumpsite reclamation

* Kumbakonam Municipality has introduced two-way segregation – with green and red bins. Citizens were asked to give medical and sanitary waste separately in plastic bags, but the initiative was short-lived.

** Plastic for this purpose is not segregated at source but at the resource recovery facility.

Source: Kumbakonam Municipality

WHAT HAS WORKED IN KUMBAKONAM

In its endeavour to become a bin-free and garbage-free town, Kumbakonam has not resorted to any shortcuts, focusing on a holistic model of waste management instead.

Decentralised waste management and source segregation have yielded good results for this heritage town. Students, resident welfare associations, self-help groups and other important stakeholders have been made an integral part of the transformation. The town's IEC programme on waste management has also had a positive impact. Drawing *kolams* to educate citizens on better waste management practices is an excellent idea. Rewarding good practitioners with gold coins has been helpful too.

The municipality has integrated authorised waste pickers into the management system, thus addressing the shortfall in the number of sanitary workers. While micro-composting centres have struggled to take root, as they attract flies and mosquitoes, onsite composting centres and the lone biomethanation plant processing the waste of the city's 58 bulk generators (contributing nearly 10–20 per cent of the waste) have been a success.

The biggest triumph of Kumbakonam's waste management system has been its processing of non-recyclable plastic, from the city as well as the dumpsite. Use of plastic as a refuse-derived fuel also reduces the need for pet coke in cement factories.

Managing plastic waste

Kumbakonam Municipality has tried many creative ways to reuse plastic waste. In 2015, the municipality began to sell shredded plastic waste to contractors at the rate of Rs 15 per kg. The aggregate mix and bitumen are heated together to make road material. About 16 km of new roads have been created through this process, adhering to the Union government order of 2015 that plastic be used in making roads.

The municipality was also looking for a solid, long-term solution to manage its plastic waste. Once the land under the dumpsite at Karikulam had been recovered, a resource recovery facility was constructed on it.

Kumbakonam now sends its plastic waste to Dalmia and Ultratech cement factories. The municipality bears the transportation charges as the aim is to get rid of the plastic waste and not make money from it. Non-recyclable plastic waste is used as refuse-derived fuel, replacing some of the pet coke used in these factories. Pet coke and refuse-derived fuel are used in an 80:20 ratio.

Currently, there are no takers for reusable plastics such as thin-sheet covers on water bottles. Earlier, the municipality used to sell them to a recycling company in Erode, providing monetary benefits to sanitary workers as a collection incentive. But for the past one year, recyclable waste is accumulating as the Erode company has paused its business.

A year ago, Kumbakonam Municipality also performed an incineration trial run for plastic waste, but the state Municipal Administration and Water Supply department and the Tamil Nadu Pollution Control Board did not give permission to operate incinerators.

Impacts

- Kumbakonam is one of the few towns in the state utilising non-recyclable plastic in an eco-friendly manner as refuse-derived fuel in cement factories.
- Kumbakonam is also one of the very few towns utilising other non-biodegradable waste materials such as coconut shells and liquor bottles in a productive way.
- Kumbakonam Municipality bagged the third prize in Swachhata Excellence Award, 2019 for including self-help groups in its waste management mission.
- It is the first municipality in Tamil Nadu to have successfully used biomining technology for reclaiming a dumpsite.
- At its peak, segregation in the city stood at 80 per cent — a notch higher than most other municipalities in Tamil Nadu.
- Across the country, 11 projects similar to the Kumbakonam plastic waste processing model have been completed till now.

LESSONS LEARNT

Waste is a resource, not a burden: It would be easy for a small town with limited resources to view a dumpsite that contained biodegradable waste mixed with plastic and other types of waste as a financial and logistic burden to clear. But, by signing agreements with nearby cement factories, the municipality has been able to utilise plastic waste recovered through biomining as fuel. Recyclable fraction is recycled.

Decentralised biodegradable waste management makes a lot of sense: Kumbakonam's decentralised food and garden waste processing is yet to achieve the desired benefits more so in the case of onsite composting centres than in the case of micro-composting centres. Biodegradable waste is generally bulky and its transportation a costly affair. Decentralised processing can generate manure that can be utilised locally. However, the town also has a biomethanation plant, **showcasing the benefits of centralised processing of biodegradable waste.** A combination of the two methods suited to local conditions might be an optimum solution for most urban centres.

REPLICABILITY

Kumbakonam's case proves that processing single-use plastic is a technically feasible solution for a city with proper segregation of waste. However, proximity of co-processing facilities (like cement factories) is an essential factor for end-use of refuse-derived fuel, as the cost of transportation is a factor. According to Central Public Health and Environmental Engineering Organisation guidelines, the transportation cost of refuse-derived fuel should be borne by cement factories using them, but only if they are within a certain distance. Kumbakonam has found a viable market for reuse of recyclable plastic. While the financial returns are not sufficient at present, the municipality considers it a profitable deal in terms of the environmental advantages of recycling or processing plastic.

Kumbakonam's model of biomining its dumpsite has already been adopted by many urban local bodies in Tamil Nadu and nationally, a testament to its replicability.