

# A-Z OF SOLID WASTE MANAGEMENT: INITIATIVES BY DELHI SCHOOLS

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## Abstract

The world is a beautiful place for all human kind but our recent activities has adversely affected the environment. The damage made to the eco-system will be irreparable if adequate actions are not taken immediately. Schools play a vital role in shaping students to choose the right path in their life. Imparting environmental education during the early years of learning can ensure a future generation that is sensitive towards environment. The following research paper discusses various practices adopted by selected schools in Delhi, India to control (reduce, reuse and recycle) their solid waste and empower students at the same time.

## Key words

Solid waste management, Delhi schools, environment conservation, waste wise school

## Introduction

Rapid population growth and economic development along with inadequate infrastructure, land scarcity and depleting resources makes the management of urban solid waste one of the most critical environmental issue for developing countries around the world.

Waste is created as a result of human activities, and it is the way this waste is collected, segregated, handled, transported and disposed that pose a threat to the environment as well as to public health and safety [1]. Urban solid wastes can be defined as discarded solid materials generally found in and around the cities; it includes material like paper, metals, glasses, food items, plastic, tyres, clothes and leathers [2]. The problem faced by municipal authorities in providing the most basic services has been acknowledged by many governments across the world [3].

The conventional model of urban solid waste management (collect, transport and dispose) has proven to be ineffective and unsustainable as it fails to understand the specific needs of each region. Inefficient management of solid waste can lead to various health and environmental problems like ground and surface water

contamination, generation of inflammable gasses, soil erosion, epidemics, soil acidity and release of green house gases [4].

*Characteristics of urban solid waste in developing countries:* The characteristics of urban solid waste generated in a country is dependent not only on the living standards and lifestyle of the inhabitants but also on the type and quantities of resources available in the region. Urban waste can be broadly divided into organic and inorganic based on their nature. Availability of higher organic component is the primary difference characterizing the solid waste generated in developing nations against their developed counterparts [5].

According to the article published in Times of India (March 2020), India was generating 277 million tonnes of waste each year in 2016 which is projected to double by 2050. Delhi, the capital city of India is the highest generator of solid waste in the country [6]. Urban solid waste includes materials that may take from 3 days to 1000 years to degenerate (Table 1.1). Many people still do not understand where the trash goes and how much time it takes for each type of waste to generate.

**Table 1.1: Time taken by waste materials to decompose**

Paper	10 – 30 days
Paper towel	2 – 4 weeks
Orange and banana Peel	2-5 weeks
Apple core	2 Months
Cotton garments	2 – 5 months
Woollen items	1 year
Plywood	1 – 3 years
Plastic bags	10 – 20 years
Plastic foam (Styrofoam)	50 years
Tin, aluminium and other metal items	80 – 200 years
Glass bottle	1 Million years

Source: [7]

*Importance of sound urban solid waste management programme:* Municipal corporations responsible for managing UMSW (Urban Municipal Solid Waste) in developing countries like India face various challenge in providing a dynamic and effective system to the society [8]. Municipalities use major portion of their financial resources on collection of waste from different locations and thereafter left with very little funds for its efficient management [9]. In developing countries, municipal corporations barely spend 0.5 % of their per capita GNP (Gross National Productivity) on services for managing solid waste. [10]. This is mainly because of various legal, technical, social, economic and financial challenges that the system faces like inefficient staff,

lack of infrastructure, lack of technical expertise, inappropriate collection system and unorganized planning and segregation

*Urban solid waste management in Delhi:* The city of Delhi is spread over an area of 1486.44 square km and caters to a population of approximately 179.5 lakhs (2018). There are 5 municipal corporations overseeing the management of urban solid waste in the city [11]. Delhi generates 9,500 tonnes of waste daily, out of which only 8,000 tonnes/ day is collected from 280 wards and sent to three landfill [12].

Municipal solid waste management is one of the major environmental problems of Indian mega cities as a lot of waste stills finds itself in the low-lying areas without taking any precautions. The most common method of disposal being land filling, the city is facing difficulties in providing the desired levels of public service [13]. Insufficient funds, lack of education, untrained manpower and absence of awareness are some of the biggest reasons for a not so successful system in place.

Solid waste management in Delhi schools: Delhi has a very strong education system with 5760 education institutions (managed by private sector, and state and central governments) catering to almost 20% of the total city's population [14].

To address the problem' of solid waste along with other environmental problems, the government of India introduced the National wide programme known as the 'National Green Corps' in 2001-02 to meet the objectives of environment conservation [14]. As a part of this, the eco-club programme was introduced for educational institutions across the country to redirect energy and actions of young '**change makers**' towards a sustainable environment through different educational approaches [15].

It is believed that the future of the city lies in the hands of students who are the '**young change makers**'. They can be taught about environment and need for its conservation as it easy as they have the ability to retain information, generate awareness among societies and promote environment conscious practices.

This paper was attempted to understand the efforts made by schools in the capital city of India towards sustainable environmental practices for the welfare of the nation and human race. It is believed that the young children represent the future of the world. Early environmental education can help in moulding students' perception in the correct direction and bring a significant difference in how they perceive the environment around them. Schools play a vital role in achieving this as students spend considerable time acquiring formal education.

## Methodology

The study was conducted in the National Capital Region (NCR) of Delhi which is also the capital city of India. Most of the population of Delhi lives in highly-dense arears and come from different cultural and economic backgrounds. The study area included eco-club educational institutions from the city. Twenty-six (26) schools were selected from 9 zones of the city based on their active participation in eco-club programme for more than 5 years.

Sample size comprised of semi-structured interview schedule with 26 eco-club teacher coordinators and transect walk for mapping practices related to management of solid waste in the school premises. The data gathered from various tools was tabulated for further analysis.

### Observation and Assessment

The observations of the study revealed that most of the schools selected for the survey were actively engaged in environmental activities and ensured student involvement in the same. Each school participating in the study was involved in various sustainable practices at any given time of the year. While some educational institutions preferred continuing with repeated set of activities like tree plantation and cleanliness drives on annual basis, others were improvising and adopting new activities and programs like cactus park, vermi-composting and tetrapak recycling.

Based on the results of the survey, a comprehensive list/ glossary was prepared of A-Z terms undertaken by selected schools in their endeavour towards environment conservation and healthy living.

**Table 2: A to Z of solid waste management practices in selected schools**

A-Z	No. of schools	Descriptions
A Aerobic composting	25	Aerobic composting involves decomposition of organic matter in the presence of microorganism and oxygen. The compost prepared helps give soil a better structure and adds extra nutrients. A large number of schools were involved in the activity as it was identified as one of the easiest method of composting garden waste.
B Best out of waste	25	Making products from various solid waste materials like classroom paper, newspaper, cardboards, CD's, plastic containers and glass bottles is a smart way of promoting innovative craft and reduce the waste going into the landfill. More than 90% of the schools were engaged in best out of waste practices on a regular basis for classroom projects and school events like annual day and sports meet.
C Cleanliness drive	6	Cleanliness drive is an awareness generation activity aimed at introducing communities to need and importance of having a healthy environment and clean surrounding. Many schools forming part of the survey were organizing regular cleanliness drives especially in the months of June-August when the chances of water and mosquito borne diseases increase to a great extent.



<p><b>D</b> Donation of Books, uniform and stationary</p>	<p>13</p>	<p>A smart way of reducing waste is to reuse item not required. Donating products like old books, uniform and stationary can help children learn to empathise and help those in need.</p> <p>Many schools were collecting old books, school uniform and stationary goods from students and sharing them to other students and communities in need.</p>
<p><b>E</b> E-waste recycling</p>	<p>14</p>	<p>E-waste generated in schools generally includes CD's, pen-drives and hard drives. Other big items like computers, CPUs, screens and projectors were usually repaired and rarely discarded.</p> <p>E-waste collection boxes had been set up in some schools for students and the products collected was sent to authorized recyclers in the city.</p>
<p><b>F</b> Free Organic manure distribution</p>	<p>8</p>	<p>The compost generated from aerobic and anaerobic decomposition acts as substitute for inorganic fertilizers for adding essential nutrients to the soil.</p> <p>Schools composting organic waste on a regular basis were promoting organic gardening by sharing excess manure with students, parents and nearby communities though free sample distribution.</p>
<p><b>G</b> Grouping of waste</p>	<p>8</p>	<p>Grouping of waste into green (organic waste) and blue (inorganic waste) is an essential activity for effective treatment and disposal of urban solid waste generated in the city schools.</p> <p>Only a handful of schools were seen grouping solid waste generated in schools into blue (inorganic) and green (organic waste). Most schools had space concerns for keeping two dustbins.</p>
<p><b>H</b> Help from organizations</p>	<p>21</p>	<p>Curriculum over burden, lack of time and limited staff are some of the common reasons schools face in an effort to indulge in solid waste management practices.</p> <p>Schools collaborating with external organization (government, private and NGO) were found to be more active/ regular in running their environmental programmes and interested in trying new activities like paper recycling.</p>
<p><b>I</b> Increasing green Cover (Plantation)</p>	<p>26</p>	<p>Tree plantation has been found to be one of the most effective method of reducing the effect of human activities on environment like carbon emissions.</p> <p>It was the most common environment conservation practice adopted for reducing land, water as well as air pollution. Every school forming part of the study was involved in regular plantation drives in and around their school premises.</p>

<p><b>J</b></p> <p>Judicial Legislations – following MSW(M&amp;H) Rule</p>	<p>3</p>	<p>The new Municipal Solid Waste (Management and Handling) Rule, 2018 makes it mandatory for all institutional buildings (schools and colleges) to segregate waste into bio-degradable and non-bio-degradable before discarding it.</p> <p>Only a few schools participating in the survey were following the instructions set by the government. Others were unable to practice it owing to various reasons like lack of support from teaching and non teaching staff, insufficient time and inefficient municipal collection systems. Strict regulations are required to bring the laws in place.</p>
<p><b>K</b></p> <p>Knowing the composition of waste</p>	<p>1</p>	<p>It is essential to know the composition of waste in order to understand and identify effective disposal practices. Studies have shown that more than 50% of urban solid waste generated in Delhi is biodegradable in nature.</p> <p>The analysis of activities undertaken by schools revealed that only one schools was paying attention to the composition of solid waste produced on a daily basis.</p>
<p><b>L</b></p> <p>Leaf Mulching</p>	<p>3</p>	<p>Leaf mulch is beneficial for buffering soil temperature and improving soil fertility thereby reducing the need for fertilizers and protecting plants.</p> <p>Very few schools had leaf mulching machines installed in their garden areas for ease of transporting plant waste and the organic mulch generated was used for their lawns and gardens.</p>
<p><b>M</b></p> <p>Mapping of solid waste in school premises</p>	<p>2</p>	<p>Mapping of solid waste is a practice of identifying the areas in school where maximum waste is generated and accumulated. It also helps in finding the most suitable location for collecting waste away from the reach of the school students.</p> <p>Only two schools participating in the study had conducted solid waste mapping and taken corrective measures to collect and dispose daily waste efficiently.</p>
<p><b>N</b></p> <p>Newspaper collection</p>	<p>25</p>	<p>Most schools in Delhi and across India receive daily newspapers for students in classes in collaboration with leading media houses.</p> <p>Many schools had tie-ups up leading newspapers to provide daily hard copies to students from classes IV to XII. Almost all selected institutions were collecting left over newspapers after school hours and sending them for recycling or selling them to <i>kabadiwala</i>'s.</p>

O Organic farming	17	Organic farming is an age old practice that helps in maintaining soil fertility, reduces soil erosion and promotes the local biodiversity. All schools with big fields had adopted organic farming for growing basic vegetable and flowering plants. Schools were also engaging students regularly to promote the practice.
P Plastic bottle reusing & recycling	6	Recycling and reusing of plastics like containers, bottle, stationary and bags is essential for the planet and all living organisms as it has already entered our food chain and takes millions of years to degrade. Only a handful of schools were found to handling their plastic waste in the following ways: Reusing plastic- as planter, for drip irrigation in planters, in yoga mats for base, Recycling plastic – into fashion jewellery, coasters, Selling to Kabadiwala's or authorized recyclers.
Q Quantity of waste generated	1	Similar to composition, quantity of waste generated in schools on a daily basis plays a vital role. It helps in understanding the child/day generation of waste which in turn can supports schools in reducing their overall waste. Except for one, all other schools had little knowledge about the quantities of solid waste generated in their premises on daily basis. They were only able to measure it in terms on number of jute bags or <i>rikshaw</i> 's.
R Reduce, Reuse and Recycle	26	Reduce, reuse and recycle of various solid waste like plastic, metals, glass and old furniture is essential to prevent the environmental hazards. All schools surveyed in the study were involved in one or the other activity for managing their non-biodegradable waste like repair and reuse of old furniture and selling metals and glass to <i>kabadiwala</i> 's.
S Swachh Bharat Abhiyan	26	The governments initiative of <i>Swatchh Bharat Abhiyaan</i> is a nation wide mission launched in 2014 to promote clean surroundings and create public awareness. Each school participating in the survey has adopted the mission and were trying to make conscious effort towards keeping their surroundings clean and spread awareness among students through various activities like competitions, debates, seminars and visits.

T Tetrapak recycling	2	<p>Schools generate large quantities of tetrapak's in the form of milk and juice containers. Recycling of tetrapak's helps reduce the waste going into over-burdened landfills and at the same time educate children about the healthy practice of taking care of their own waste.</p> <p>Only a few schools were involved in cleaning, drying of tetrapak and sending sending them for recycling on a regular basis.</p>
U Unorganized sector-waste segregation ( <i>kabadiwala</i> )	14	<p>Unorganized sector plays a very important role in managing urban solid waste in India. <i>Kabadiwala</i>'s (Ragpicker) are responsible for a large portion of paper waste collected and recycled in the city. They also help in recycling other waste like plastic and glass bottles, aluminium cans and big metal pieces.</p> <p>Most of the schools had employed local <i>Kabadiwala</i>'s for segregation of solid waste which not only helped them in handling waste at the source of segregation but also provide livelihood to <i>kabadiwala</i>'s who were selling them back to the industry.</p>
V Vertical garden	1	<p>Vertical gardening was yet another method of using old plastic bottles and cans used in school surrounding to create a garden on the wall that only took very little space but provided healthy environment and clean air to all students.</p> <p>Though only one school was found to be engaged in this practice at the time of the study, it was fast growing in popularity especially because of the very little space and maintenance required.</p>
W Waste Segregation	9	<p>Segregation of solid waste either at the source of generation or at the main collection point is essential before disposing of waste into the landfill.</p> <p>Only selective schools were segregating waste at source (classroom) or at the main collection point in the premises into three categories - compostable, recyclable and landfill waste.</p>
X Xploring new ways to use waste	9	<p>The key to a successful environmental programme is to always revolutionise and find new ways to reduce, reuse and recycle waste.</p> <p>Some schools had explored new and innovative ideas to use solid waste like filling yoga mats with waste plastic bags, using egg trays for sound insulation in music room, creating vertical garden using plastic bottle and planting lemon grass around classrooms to act as a mosquito repellent.</p>



<b>Y</b> Yearly Audits	3	Environmental Audits can help education institutions assess their physical environment in terms of indoor air quality, solid waste management and pollution among various other parameters. A large number of schools participating in the study were conducting annual environmental audits to check their progress and to further improve their efforts towards a sustainable built environment.
<b>Z</b> Zero-Waste Zone		Creating a zero-waste zone should be the ultimate objective of all schools. By participating in activities listed in A-Y, it is possible for any school to become a waste smart institutions where all urban solid waste generated is managed through 3R's – Reduce, Reuse and Recycle.

While the performance of some schools was better than others, they were all trying to give their best to the students by impart right values towards sustainable environment. Most of the activities adopted by selected schools were found to be cost-friendly and easy to practice.

Though all educational institutions surveyed were making an effort but only one school was found to be engaged in most of the above mentioned activities.

### Suggestions:

Effective solid waste management in educational institutions involves various stakeholders and it is important for all of them to work together towards one single goal – providing safe and healthy environment to our future generations. Thus making it essential for schools in the city to adopt environment conservation practices incurring a little cost but the greater good of the world. Following are some suggestions:

- Survey for identifying the quantities and composition of solid waste in schools is most important to understand school waste. It will help in identifying different types of waste generated and major waste generation and collection points.
- Effective management of solid waste at the source of generation is essential as it can help in understanding the waste and avoiding use of unnecessary resources, waste minimization, on site storage, effective collection and source segregation
- Identification of solid waste materials that can be reused, recycled and refurbished will help in reducing the waste discarded.
- Involving local authorities like municipal corporations who can improve their services by adding more staff, increasing fund allocation and training of the personnel.
- Recognizing the potential role of private and non-governmental organizations is also recommended to meet the gaps between solid waste generation and effective disposal. These organizations can also assist in giving more exposure to educational institutions by introducing student centric programmes aiming at environment conservation.

- Development of tools and documents like training modules, on field training, booklets and e-portals can also help schools in understanding the new technologies and practices that can be adopted for handling solid waste efficiently.
- Governments also need to develop and implement legal framework like guidelines and regulations for monitoring and improving the system's efficiency.

Though it is not easy for any educational institution to achieve zero-waste but by adopting the listed activities and more, it is possible for any school to become waste-wise. This can be easily achieved with vision, time and minimum investment of resources (like time and money).

### **Conclusion:**

Schools act as second home for students and they cater to more than 20% of city's population in Delhi. Many people do not realize the role education can play in implementing conservation strategies for preservation of environment. Schools have the potential to not just educate young minds but also promote sustainable environment management through them. The results of the study conducted revealed that educational institutions have the potential to adopt and promote environment conservation.

The findings of the study show that though the implementation of effective solid waste management practices has not reduced the inappropriate disposal behaviour of the communities, yet schools in Delhi have been able to come up with some effective solutions and innovative methods for handling solid waste efficiently and reducing the overall impact on the environment.

A sustainable system of solid waste management in education institutions is successful only if it is able to identify the sources of solid waste and deal with different types of waste materials generated on a daily basis. By adopting the activities listed above and experimenting with new approaches, reducing the production of solid waste is possible. Schools have the most important resource – Human resource – which if conditioned appropriately can help bring a change in the way we see the world around us.

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**Abbreviations**

GNP (Gross National Productivity)

UMSW (Urban Municipal Solid Waste)

