

ENVIRONMENTAL DEGRADATION DUE TO SOLID WASTE: A CASE STUDY OF KANPUR CITY

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ABSTRACT

Solid waste refers to any discarded material that is generated in the city as a result of human activities, such as household waste, commercial and industrial waste, construction and demolition waste. In Kanpur city the assumed production of waste material is 1kg/capita/day (2021). Due to push and pull factors of population, changes in the living standard and rapidly growing urbanization, the waste production in kg/capita/day have increased by 0.1 for the upcoming period. The effects of solid waste on the environment includes water pollution, soil contamination, air pollution, climate change, biodiversity loss and public health hazards in the city. To address these impacts, several key steps can be taken, including proper waste management practices, investment in modern waste management infrastructure, public education and engagement, sustainable production and consumption, enforcement of regulations, promotion of research and innovation. Integrated solid waste management (ISWM) systems are comprehensive approaches to managing solid waste that aim to minimize the environmental and health impacts of waste and maximize resource recovery.

Keywords: Biodiversity loss, ISWM, Public Education, Waste Management Infrastructure, Greenhouse Gas Emission, Air Pollution, Transportation.

INTRODUCTION

Environmental degradation due to solid waste is a growing problem in many cities including Kanpur. Improper disposal of solid waste results in a range of environmental and public health impacts, including air and water pollution, soil contamination, and the spread of disease. In Kanpur, the issue is particularly severe due to a lack of proper waste management infrastructure and practices.

Inadequate landfill sites and improper waste collection and transportation systems are major contributors to the problem. The city does not have sufficient landfill sites to accommodate the increasing amount of waste generated and the existing landfills are often poorly managed and overfilled. The waste is often burned or dumped in open areas, leading to air pollution and the release of toxic fumes into the atmosphere. The waste also leaches into nearby water sources, contaminating them and putting local communities at risk of waterborne illnesses.

The lack of public awareness about waste management is also a major problem in Kanpur. Many people are not aware of the environmental and public health impacts of improper waste disposal and they do not understand the importance of proper waste management practices.

This lack of awareness leads to indiscriminate littering and dumping of waste, which exacerbates the problem. To address these issues, the government and local organizations need to implement sustainable waste management practices in Kanpur. This includes composting, recycling, and waste-to-energy projects.

Community education and engagement are also crucial in promoting proper waste disposal and reducing environmental degradation in Kanpur. In terms of Nation India generates 1.45MT of wastes per day at present and is facing a municipal solid waste dilemma, for which all elements of the society are responsible. This can help to foster a sense of responsibility among local communities and encourage them to adopt sustainable waste management practices.

AIMS AND OBJECTIVES

- To educate people about the importance of proper waste management.
- To reduce the probability of environmental hazards & degradation causing human health risk.
- It also aims to optimize waste generation and increase energy production.
- To describe the human's behavioural system towards Integrated Solid Waste Management.
- To encouraging community participation in waste management activities.

REVIEW OF LITERATURE

This book contains the information about all types of waste that are generated mainly from residential and commercial complexes. Due to increasing urbanization and improper waste management human health suffers high risks of devastation. Inequal division of resources, unplanned industrialization in India disturbs the stability of population density and the whole process come out with improper MSW generation regularly. (Srivastava, 2020).

This book summarise that solid waste management is a crucial issue that requires urgent attention. There is a need for a comprehensive approach to solid waste management that includes waste segregation, recycling, composting and proper disposal. It is essential to raise awareness among the public and encourage responsible waste disposal and management practices. (Nag, 2005)

METHODOLOGY

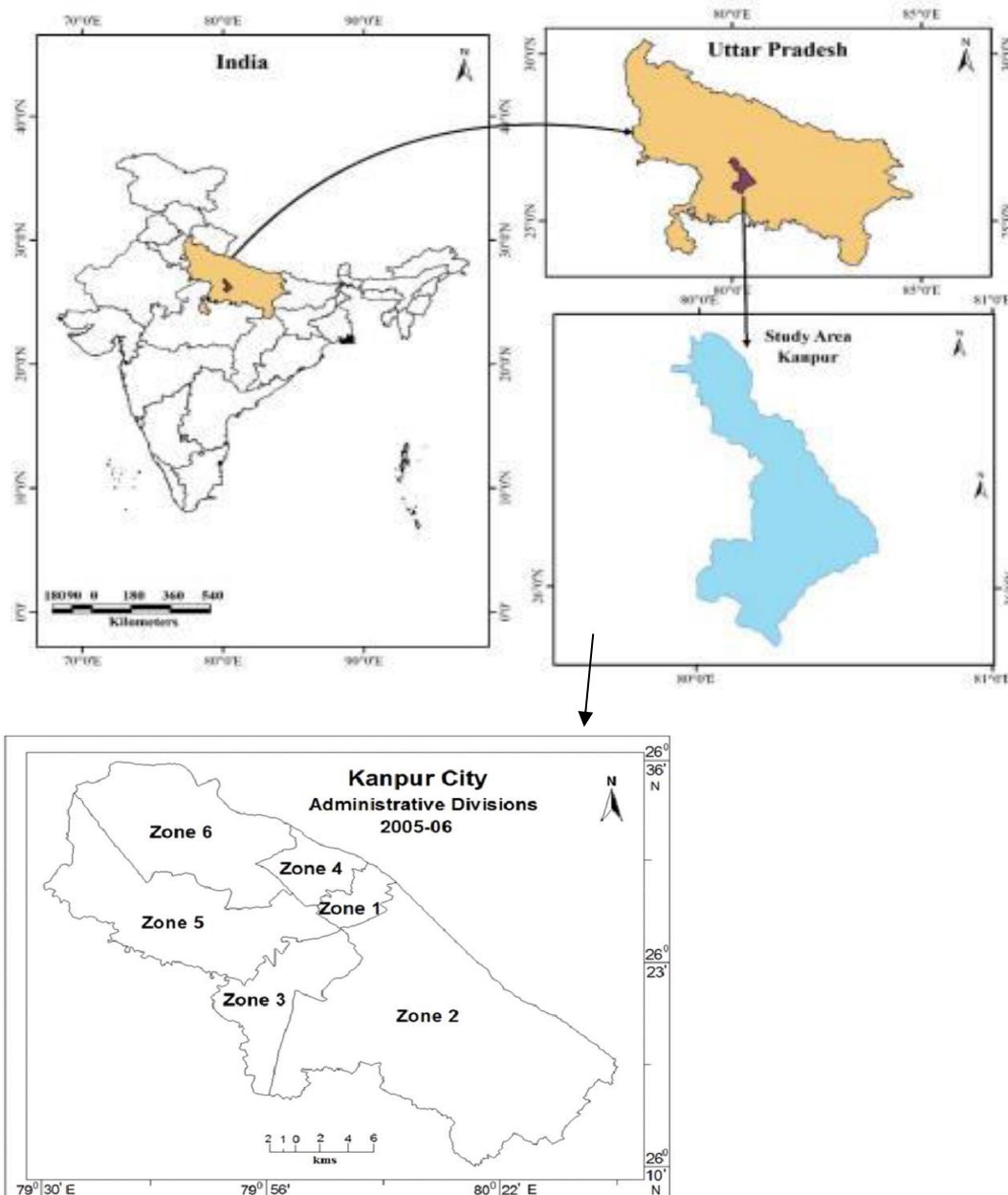
Relevant data and other information will be collected from published reports, journal & from other valid websites related to the topic of research. As the topic has a very wide scope so the secondary sources at national and international level will be preferred.

Secondary Sources: - There are organizations like CPCB, KDA and other organizations for environment and development, published and unpublished reports are also helpful during study. Data has been collected from some research papers and research journals too.

STUDY AREA

Kanpur city (26°28' 15" N latitude and 80°23' 45" E longitude), the industrial capital of Uttar Pradesh, occupies a very important position in Northern India. It is situated on the right bank

of the river Ganga. It is in upper Ganga Plain and covers an area of about 298.98 km². It is divided into three main physiographic Zone i.e., Central, Northern well drained zone along River Ganga and Southern ill drained zone). Administratively Kanpur city has been divided into 110 wards. Besides Municipal Corporation, Kanpur urban agglomeration includes Kanpur cantonment, Armapur industrial state, Northern railway colony (Census town), Rawatpur station yard (out growth), Chakeri (Census town) and Indian Institute of technology.



Kanpur is one of the largest cities in Uttar Pradesh, India. The city generates a significant amount of solid waste every day, which has a harmful impact on the health and wellbeing of its residents. According to a report by the Central Pollution Control Board (CPCB) in 2019, Kanpur generates approximately 2,000 tonnes of solid waste per day however, only about 25% of this waste is collected and properly disposed of, leaving the remaining 75% to be disposed of improperly, such as burning or dumping in open spaces.

CURRENT SCENARIO OF SOLID WASTE IN KANPUR CITY

1. Collection: This involves the regular and efficient collection of waste from households, businesses, and other sources, using appropriate collection vehicles and methods. In Kanpur city there are many collection centres. 200TPD of waste is generated from household waste and 83TPD from hotels and restaurants. Door to Door collection plays a vital role in managing MSW. As per the report 554399 households in Kanpur city but only 217827 households are covered by door-to-door collection at the collection centre division of dry and wet waste can make the further procedure easy.

2. Transportation: This involves the safe and efficient transportation of waste from collection sites to transfer stations, processing facilities, or disposal sites and secondary collection process. For transportation, 132 vehicles are used to transfer the waste in dumping sites. The city is divided into four vehicle depot areas which are (a) Bhagwat Das depot (b) Jajmau depot (c) Panki depot (d) Fazal Ganj depot.

3. Processing: This involves the treatment and processing of waste to reduce its volume, separate recyclables, and recover valuable materials and energy. Processing may include composting, recycling, and waste-to-energy conversion. Processing and disposal of solid waste in the city, with the inclusion of design, construction & operation, maintenance of a 1500TPD ISWM facility and generation of electricity from the waste.

4. Disposal: This involves the safe and secure disposal of residual waste, typically in properly managed landfills. More than 400 open dumps are found in the city during the research. The total amount of waste collected and transported to the final disposal site is 6723 MT/month.

The report of CPCB highlighted that Kanpur lacks sufficient infrastructure for waste management, such as waste processing facilities and landfill sites. The existing landfill sites are almost full, and new sites are difficult to find due to the city's geographical location and high population density.

The CPCB report also stated that most of the waste generated in Kanpur is organic waste, which if managed properly, can be composted, or used for biogas production. However, due to the lack of waste processing facilities, this waste is often left to decompose in open spaces, leading to foul odours and the proliferation of disease-carrying vectors such as flies and rodents.

Moreover, the report also highlighted the issue of medical waste, which is often mixed with regular waste and disposed of improperly, posing a significant risk to public health. The report suggested the need for a separate system for the collection and disposal of medical waste to prevent the spread of infections and diseases. The current scenario of solid waste in Kanpur is alarming, with a large amount of waste generated and improperly disposed of, leading to serious health and environmental consequences. It is crucial that the authorities take immediate action to address this issue by implementing proper waste management practices and investing in waste processing infrastructure to ensure a clean and healthy environment for the city's residents.

SOURCE OF SOLID WASTE

SOURCE OF SOLID WASTE	Solid Waste Generated (TPD)
Households	200
Street Sweepings	140
Hotels and Restaurants	83
Markets (vegetable markets, mandis etc.	107
Commercial Establishments (Institutions etc)	103
Other Sources (Construction Debris, Horticulture etc)	286
Total	919

Source: - City Sanitation Plan Kanpur City (2013)

CATEGORISATION OF SOLID WASTE IN KANPUR CITY

Solid waste is any garbage or refuse that does not disintegrate or decompose easily and remains in the environment for a long time. It can be classified into various types based on its composition and origin. The following are the types of solid waste and their impact on the environment:

Organic Waste: This type of waste includes food waste, yard waste, and other biodegradable materials. Organic waste releases methane, a potent greenhouse gas, when it decomposes in landfills. It also attracts rodents, insects, and other disease-carrying vectors, leading to environmental and health hazards. In Kanpur, organic waste is dumped into panki dumpsite.

Plastic Waste: Plastic waste takes hundreds of years to decompose and poses a significant threat to the environment. It can choke waterways, harm marine life, and release toxic chemicals when burned. All the plastic waste including single used plastic mostly dumped alongside area of river Ganga & under the Jajmau overbridge

Paper Waste: In Kanpur Parade chauraha has always been a hub for paper material. Paper waste comes from various sources such as newspapers, books, cardboard, and other paper products. When paper waste decomposes in landfills, it releases methane, which contributes to climate change.

Electronic Waste: Electronic waste or e-waste is the discarded electronic devices such as mobile phones, computers, and televisions. E-waste contains heavy metals, such as lead, cadmium, and mercury, which can pollute the environment and cause health problems.

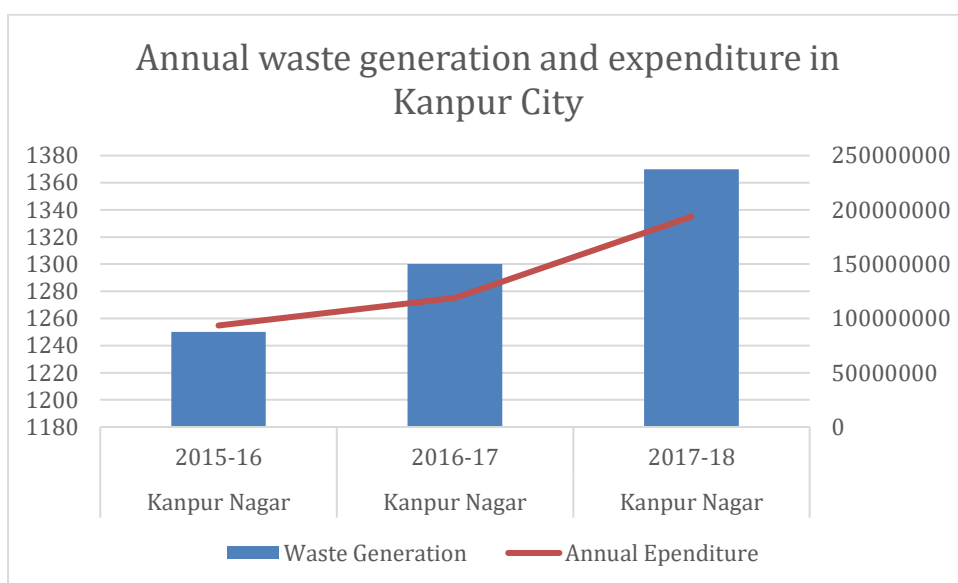
Medical Waste: Medical waste is generated in hospitals, clinics, and other healthcare facilities. It includes syringes, needles, and other hazardous materials. Improper disposal of medical waste can lead to the spread of infectious diseases and pose serious health risks.

Construction Waste: Construction waste includes debris generated from the outskirts of Kanpur that includes Chaubepur, Mandhana, Kalyanpur, during construction and demolition activities. It can create hazards for workers and the public that cause soil, water and air pollution.

In conclusion, solid waste poses a significant threat to the environment and human health. Proper waste management practices such as segregation, recycling and proper disposal can help reduce the impact of solid waste on the environment. It is essential to raise awareness among the public to encourage responsible waste disposal and management practices.

WASTE GENERATION AND EXPENDITURE IN KANPUR CITY

City Name	Year	Waste Generation	Annual Expenditure
Kanpur City	2015-16	1250	93500000
Kanpur City	2016-17	1300	119000000
Kanpur City	2017-18	1370	193800000



Source: - Website- smartcities.data.gov.in

In Kanpur city, it is stated in above index that from 2015 to 2018 growth of solid waste and increment in the expenditure are directly proportional to each other. A big gap with in the period of three years is found as statistics and the above graph indicates that in the year 2015-16 the waste generation figured around 1250 tonnes and in that year the expenditure was about 9 crores. In 2016-17 expenditure was increased from 9 crores to 11 crores meanwhile waste generation increased 50 tonnes. At last, in 2017-18 waste generation grew 70 tonnes and a great hike in expenditure was found about 19 crores. Basically, in three years first to second waste generation increased 50 tonnes with the increment of 2 crores in expenditure and second session to third 70 tonnes increment in waste generation matched with 8 crores of expenditure. These statistics shows that the ratio of waste and expenditure has increased in three years without any proper reasoning or method.

PHYSICAL ANALYSIS OF KANPUR CITY REFUSE (Dry weight by percent)

Serial no.	Item	Mixed	Do or to Do or HIG	Residential HIG	MIG	LIG	Veg Market	Comm Area	Industrial Area	Collection Depot	Disposal Site
	Sample	1	2	3	4	5	6	7	8	9	10
1	Biodegradable	34.9	58.6	60.0	38.7	29.3	34.9	29.3	58.6	60.0	38.7
2	Paper	3.7	5.1	5.8	4.8	0.6	3.7	0.6	5.1	5.8	4.8
3	Plastic	6.2	5.4	5.9	5.1	4.2	6.2	4.2	5.4	5.9	5.1
4	Rubber & Leather	2.7	2.5	2.9	2.1	1.00	2.7	1.00	2.5	2.9	2.1
5	Rags	5.1	7.6	5.6	4.0	2.3	5.1	2.3	7.6	5.6	4.0
6	Metal	-	-	-	0.01	-	-	-	-	-	0.01
7	Ceramic	-	-	-	0.01	-	-	-	-	-	0.01
8	Inert & Fine Earth	38.8	17.1	16.3	37.2	51.5	38.8	51.5	17.1	16.3	37.2
9	Fine Organic	8.5	3.8	3.6	8.2	11.3	8.5	11.3	3.8	3.6	8.2

Source: Kanpur Nagar Nigam (1999)

CHEMICAL ANALYSIS OF KANPUR CITY REFUSE

Sample no.	Item	Unit	Mixed	Do or to Do or HIG	Residential HIG	MIG	LIG	Veg Market	Common Market	Industrial Area	Collection Depot	Disposal Site
1	Ph	Dimensionless	3.00	7.5	7.4	7.8	8.5	6.9	7.7	8.2	7.2	6.8
2	C/N	Dimensionless	30.7	35.8	34.6	37.2	31.1	37.3	30.9	37.0	34.6	34.9
3	Moisture	%	40.5	57.5	60.0	50.0	52.7	64.5	36.5	32.8	37.8	36.8

4	Organic Matter		24.9	51.6	53.0	33.5	21.8	70.5	27.8	12.0	21.8	20.1
5	Organic Carbon		13.8	28.7	29.4	18.6	12.1	39.2	15.4	6.7	12.1	11.2
6	Total Nitrogen		0.5	0.8	0.9	0.5	0.4	1.1	0.5	0.2	0.34	0.3
7	Phosphorus		0.3	0.5	0.5	0.4	0.3	0.7	0.4	0.1	0.3	0.2
8	Potassium		0.8	0.6	0.6	0.8	0.9	0.5	0.4	0.9	0.9	0.9

Source: Kanpur Nagar Nigam (1999)

HARMFUL IMPACTS OF SOLID WASTE ON THE HABITANTS OF KANPUR CITY

By using the data from government sources and personal observations by analysing current scenario in the city, we discuss the harmful impact of solid waste on the habitants of Kanpur city.

1. In Kanpur city, the residential area with high medium and low-income group generates 60%, 38.7%, 29.3% of biodegradable refuse. The improper disposal of solid waste leads to the accumulation of garbage in public places such as roads, streets, and open spaces. This waste not only causes unpleasant odours but also attracts insects and rodents, which can spread diseases. In addition, it also blocks the drainage system, leading to the flooding of the city during the monsoon season.

2. The burning of solid waste rags and plastics in common area releases 27.8% of organic matter, 15.4 % of organic carbon, 0.5 % of organic nitrogen which are harmful chemical refuse. Moreover, the burning of plastic waste can release toxic fumes that can cause cancer and other serious health problems.

3. Kanpur city is best known for leather industry and it exaggerate a big amount of waste material in industrial area. 2.5% refusal of rubber and leather is found and as per the above table in residential high, medium and low-income group area, common area generates 2.9%, 2.1%, 1.00%, 1.00% of refusal of rubber and leather respectively. The toxic chemical lead, chromium, cadmium releases from leather industry pollute river Ganges.

4. At the disposal site of the city 38.7% biodegradable refuse, 4.8% paper refuse, 5.1% plastic refuse, 0.01% metal refuse and as for the chemical refuse 20.1% of organic matter, 36.8% of moisture are disposed. The dumping of physical refuse and chemical refuse in the landfills can lead to groundwater contamination. The leachate produced from the decomposition of organic waste can seep into the groundwater, polluting it with heavy metals, chemicals` and other hazardous substances.

As the research paper is based on the case study of Kanpur city and the pollution sensitive areas like Parade, Sheesha Mau Nalla, Jajmau over bridge, and area alongside Ramadevi that is highly polluted due to the emission of harmful gases from vehicles. Farmers from the outskirt land fields of Kanpur City also complain for the toxic material mix-up in the agricultural land. The improper disposal of solid waste can have far-reaching and long-lasting impacts on the environment, wildlife, and human health. It is crucial to properly manage solid waste to reduce these impacts and protect the environment for future generations.

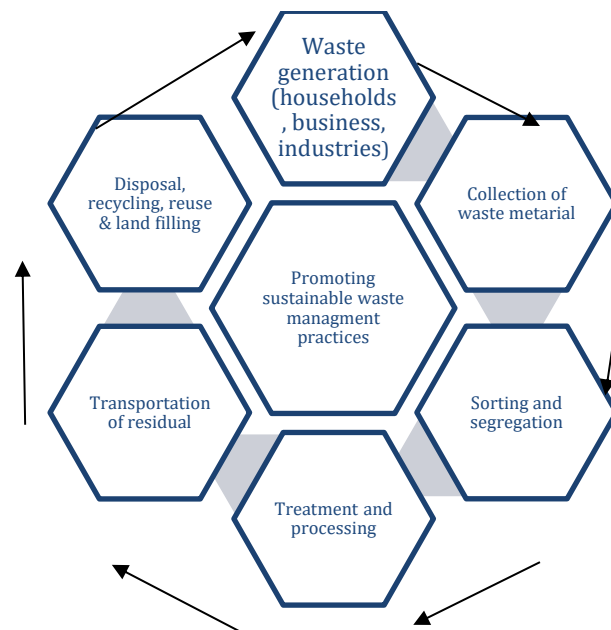
SUGGESTIONS

1. Implement proper waste management practices: This includes properly sorting and disposing of waste, composting organic waste, recycling, reducing waste through reuse and reduction. Area bordering with Panki dumping site should have soil and water purifier to decontaminate the impacts of landfill.
2. Invest in modern waste management infrastructure: This includes building new landfills and upgrading existing ones to meet environmental standards, investing in waste collection and transportation systems, developing waste-to-energy facilities. There should be transfer stations to segregate waste before final disposal at landfill.
3. Increase public awareness and education: This includes educating the public about the impacts of improper waste disposal and the importance of proper waste management practices through adds & social media. There should be seminars and workshops in colleges about waste management. Community engagement and participation can also be crucial in promoting proper waste disposal.
4. Promote sustainable production and consumption: This includes reducing the amount of waste generated, promoting the use of sustainable products and encouraging businesses to adopt more environment friendly practices. For example, area belongs with Jajmau overbridge have many manufacturing industries that release harmful gases hence to not compromise the health of factory workers there should be alternative days for workers to work.
5. Enforce regulations and penalties: Pollution through waste prone area like Ramadevi, Jajmau, Panki should have sensors to alarm the intensity of emission of harmful gases. This includes implementing, enforcing regulations, penalties for improper waste disposal and ensuring that waste management facilities and practices meet environmental standards.
6. Integrated Solid Waste Management systems also typically include a range of supporting activities such as public education and engagement, enforcement of regulations, research, innovation, monitoring and evaluation. Effective ISWM systems can help to minimize the environmental and health impacts of solid waste, conserve resources, reduce greenhouse gas emissions, and create economic and social benefits.

FINDINGS & DISCUSSION

In this research paper the presented data describes quantitative analysis of waste materials in the city. With a planned & organized strategy all the solid waste management practices should be promoted the study about the topic has come out with the fact that whole process of waste

material from generation source to dumping site must be well managed and methodical with the factors given below in the diagram.



CONCLUSION

As the Kanpur city is a commercial capital and Industrial hub of Uttar Pradesh. So Industrial sector plays a vital role in the both development and degradation of the environmental quality of Kanpur city. Solid waste management is a critical issue that affects the environment and human health. Improper waste management practices can lead to pollution, health hazards, and environmental degradation. Therefore, it is essential to adopt effective waste management practices to reduce the impact of solid waste on the environment. Kanpur city faces several challenges in managing solid waste such as the city generates approximately 2,200 tons of waste every day and most of it is disposed of in landfills without proper treatment or segregation. The inadequate waste management practices have led to air and water pollution, health hazards and other environmental issues in the city. Therefore, there is a need to adopt a more comprehensive and sustainable approach for solid waste management in Kanpur city. The current solid waste management practices in Kanpur city include waste collection, transportation, and disposal. The city needs to implement better waste management practices such as waste segregation, recycling, and composting to reduce the amount of waste sent to landfills. Additionally, there is a need to increase public awareness and encourage responsible waste disposal practise. Only through collective efforts and sustainable waste management practices, we can ensure a cleaner and healthier environment for ourselves as well as for future generations.

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