



## Solid Waste Management in Patna Municipal Corporation Area: Present Status and Measures for Improvement

• Deeksha Jha • Anugya Sakshi • Sinu Kumari  
• Debjani Sarkar Ghose

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Corresponding Author : Debjani Sarkar Ghose

**Abstract :** 'Solid waste management' may be defined as the process associated with the control of generation, storage, collection, transfer, processing and disposal of solid waste. The management of solid waste has attained highest importance in the present era globally, but basic principles of waste disposal are often neglected. Despite this, many cities are managing the solid waste and are keeping their cities clean. The situation of solid waste management is dismal in Bihar, including in its capital Patna. This present paper has been prepared after a study conducted to comprehend the current situation about waste management in Patna. The study investigated the generation of solid waste, mechanism behind the process of collection, segregation and its disposal in Patna.

It assessed the role of the authorities in the process. The survey was held in 35 wards of 6 circles with 105 households, 5 institutions and 10 of the Patna Municipal Corporation officials. The data obtained through primary survey was tabulated and expressed into percentage for analysis. The study revealed that municipal solid waste comprised more than 50 per cent of organic waste like vegetables, food waste, paper, cloth and inorganic waste like plastic, construction materials which lead to clogging of drainage system. The analysis showed the regularity of door-to-door collection in all circles during the time of survey. The results showed lack of awareness and ignorance among the households about the segregation of waste and the mismanagement of proper disposal of waste by the government which led to pollution and health hazards. Presently, waste collected from 72 wards reaches the designated dump site at village Ramchak Bairia on Gaya road where it is disposed of openly. The study clearly points out the inefficiency in the system and show the way to improve it through public and government collaboration.

### **Deeksha Jha**

B.A. III year, Geography (Hons.), Session: 2017-2020,  
Patna Women's College, Patna University, Patna,  
Bihar, India

### **Anugya Sakshi**

B.A. III year, Geography (Hons.), Session: 2017-2020,  
Patna Women's College, Patna University, Patna,  
Bihar, India

### **Sinu Kumari**

B.A. III year, Geography (Hons.), Session: 2017-2020,  
Patna Women's College, Patna University, Patna,  
Bihar, India

### **Debjani Sarkar Ghose**

Head, Department of Geography,  
Patna Women's College, Bailey Road,  
Patna-800 001, Bihar, India  
E-mail : [debjani.geog@patnawomenscollege.in](mailto:debjani.geog@patnawomenscollege.in)

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### **Introduction :**

'Solid waste management' is a part of public health and sanitation, and is entrusted to the municipal government for execution. Solid waste management (SWM) has become an acute problem in India due to rapid urbanization and uncontrolled growth of population. 'Solid waste' can be classified into different types of waste depending upon their sources: municipal solid waste, hazardous waste, industrial waste, agricultural waste and bio-medical waste. Throughout

history, waste has been generated by human beings. But the onset of industrialization and sustained urban growth of large population centres in India, the resultant buildup of waste in cities caused a rapid deterioration in the level of sanitation and the general quality of urban life. Waste management in India falls under the purview of the Union Ministry of Environment, Forest and Climate Change (MoEF&CC). In 2016, the ministry released the solid waste management (SWM) Rules, 2016, replacing the municipal solid wastes Rules, 2000.

Solid waste management in Patna is an overall responsibility of the Patna municipal corporation that is eligible for grants from the central and state governments. Despite this, Patna is one of the dirtiest state capitals of the country where management of solid waste is not done properly compared to most of the cities of the country. The situation becomes dismal during the rainy season and becomes a source of health hazard of the residents.

#### Review of literature :

Different authors have studied thriving solid waste management prevalent in different parts of the country due to concern about the environment. Rising Income, rapidly growing but unplanned urbanization and changing lifestyles have resulted in increasing volumes and changing composition of municipal solid waste in India (Ahulwalia, 2018). The management of waste becomes complex and the facilities provided cannot cope with the increasing demand and needs. Therefore, the best approach needs to be implemented immediately while considering environmental, social and economic aspects. Municipal Solid Waste Management (MSWM) has become an acute problem in Patna due to rapid urbanization and uncontrolled growth rate of population (Pandey, 2014). Singh and Raj. (2015) has studied how the Government and pollution control board has failed to tackle solid waste management problems in Patna.

#### Objectives :

The main objectives of the study are

1. To find out the composition of solid waste in Patna.
2. To know the spatial variations of solid waste management in Patna.
3. To observe the role of the Patna Municipal Corporation in the collection and managing solid waste.
4. To assess the impact of solid waste on public health and environment.
5. To investigate the success of government policies for solid waste management in Patna.
6. To suggest measures for improvement of solid waste management.

#### Hypotheses :

1. The management of solid waste in Patna is not sufficient.
2. Waste is dumped in an unorganized manner in the Patna Municipal Corporation area.
3. Non-segregation and unsafe disposal of solid waste in the city may cause environmental hazards.

#### Methodology :

The methodology of the study involves conceptual as well as the applied techniques of research. The research work is based on a distinct methodology, which follows the three stages:

##### 1. Pre-field survey stage:

- Study of relevant literature.
- Collection of study materials, data and maps.
- Visit libraries, websites concerned and government offices.
- Conducting a pilot survey.
- Preparation of a questionnaire.

##### 2. Field survey:

- Survey of 105 households in six circles of Patna, 10 Patna Municipal Corporation officials and staff members and five different institutions.

##### 3. Post-field survey stage:

- Analysis of secondary data.
- The compilation, tabulation and cartographic treatment of primary data.
- Preparation of paper.

**Database:** Data is generated by sample survey of 105 households in six circles. Among them, 21 households are from New Capital Circle, 17 from Patliputra, 20 from Bankipur, 10 from Kankarbagh, 17 from Azimabad and 20 from Patna City Circle.

**Study area :** The study area of the current work is the Patna Municipal Corporation area. Patna, the capital city of Bihar, is situated at 25°36'0" N latitude and 85°7'0"E longitude. It is the largest city of the state spreading over an area of 109.2 sq km. It is the most important administrative and commercial centre of the state as well. The Patna Municipal Corporation area has been divided into 72 wards which have been further re-arranged into 6 circles, namely- New Capital, Bankipur, Kankarbagh, Patna City, Patliputra and Azimabad.

**Analysis :** Patna is one of the oldest cities of the country with a high density of population. The city has a population of 16.84 lakh as per the 2011 Census report. Among them, 53.05 per cent are male and 46.95 per cent are female population. Population density of the city is 15,640 persons per sq. k.m. The literacy rate is 83.37 per cent with the male literacy rate of 87 per cent and the

female literacy rate of 83 per cent. The large population is responsible for the generation of a huge amount of solid waste and requires management of gigantic amount of waste.

**The socio-economic composition of the sample population :** The socio-economic composition of the sample population shows the family structure, occupational structure, income structure, and educational attainment of the area under study.

**Population composition:** Being the administrative capital and centre of attraction, Patna has the highest migrated population as compared to other districts of Bihar. Table 1 shows population composition of sample households of the Patna M.C. area.

**Table 1. Population Composition of Households of Patna M.C. Area\***

| Circle      | Male (%) | Female (%) | Total (%) | Average size of family |
|-------------|----------|------------|-----------|------------------------|
| New Capital | 45.5     | 54.6       | 100       | 4.6                    |
| Patliputra  | 47.9     | 52.1       | 100       | 7.11                   |
| Bankipur    | 49.5     | 50.5       | 100       | 5.75                   |
| Kankarbagh  | 37.8     | 62.2       | 100       | 9                      |
| Azimabad    | 46.9     | 53.1       | 100       | 4.88                   |
| Patna City  | 36.7     | 63.3       | 100       | 4.9                    |

\*Based on Sample survey, July, 2019.

In most of the sample households, female members outnumbered male members signifying selective male migration. It is further evident from the table 1 that the average size of families in Kankarbagh is the highest (9) followed by Patliputra (7.11) and others. The survey shows that the average size of the family member in the Patna M.C. is 6. The large size of the family is responsible for the generation of more solid waste compared to small family. Most of the families have a joint or extended family norm, while some households stay in nuclear families.

**Occupational structure:** In the Patna M.C. area, work participation rate among women is quite low, which is clear in the sample survey also. The male population in sample households is engaged in secondary or tertiary sectors, and 80 per cent of the female members are homemakers. The working population mainly includes businessmen, small shopkeepers, government officers, bankers and private workers. In all households, the dependent student population predominates, signifying a large proportion of youth in the population.

**Income structure:** Income distribution reflects the nature and extent of inequalities in the incomes of individuals or households in a given society. Table 2 shows the monthly incomes of the individuals surveyed in the Patna M.C. area and is categorized in different ranges. The table clearly indicates that the survey covered all segments of population of the society with varied income groups.

**Table 2. The Income Structure of Households in Patna M.C. Area\* (In%)**

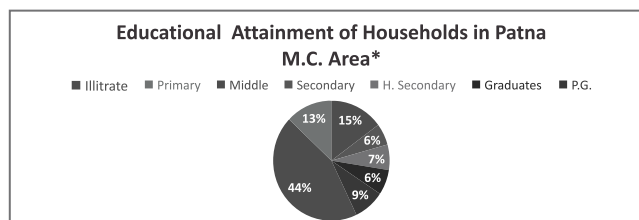
| Circle      | <5,000 | 5000-25000 | 25,000-50,000 | >50,000 | Total (%) |
|-------------|--------|------------|---------------|---------|-----------|
| New Capital | 19.1   | 4.7        | 28.5          | 47.7    | 100       |
| Patliputra  | 23.6   | 23.6       | 23.6          | 29.2    | 100       |
| Bankipur    | 15     | 35         | 10            | 40      | 100       |
| Kankarbagh  | 20     | 30         | 20            | 30      | 100       |
| Azimabad    | 23.6   | 5.8        | 35.3          | 35.3    | 100       |
| Patna City  | 25     | 20         | 15            | 40      | 100       |
| Total       | 20.9   | 17.1       | 20            | 42      | 100       |

\*Based on Sample Survey, July, 2019.

It is evident from the table that the monthly income of 42 percent of the surveyed population is more than 50,000 and most of them belong to New Capital circle. This indicates that the people living in New Capital areas are well off and their quality of life is better than the rest of the residents of the city.

**Educational attainment:**

Education helps to study things rationally. Being rational might help the people to know about the disposal of waste and solid waste management. Fig. 1 show the educational attainment of the sample population : 44 per cent of the surveyed residents are graduate, while 13 per cent of the residents are school dropouts. It is expected that educated population would manage their solid waste in a sensible manner.



\*Based on Sample Survey, July, 2019

**Fig. 1**

**Composition of solid waste :** Solid waste means 'useless and futile solid materials'. It can be generated anywhere from households to institutions or industries. Apart from regular household waste, solid waste also comprises biomedical waste, horticultural waste, construction and demolition waste from the houses and institutions, sludge from sewage treatment plant, slaughterhouse waste, e-waste, etc. Institutional waste is accumulated on a large scale as a large number of people is involved in one place. As per BUIDCO, at present 1300 TPD of solid waste is generated every day in Patna.

**Households in the Patna M.C. area:** The composition of household waste generally consists of food, plastic materials, packaging materials, dilapidated clothes. The composition of solid waste in the Patna M.C. area is evident from the table 3.

**Table 3. Composition of Households Waste in the Patna M.C. Area\***

| Circles                | New Capital |      | Patliputra |      | Bankipur |     | Azimabad |      | Kankarbagh |     | Patna City |     | Total |
|------------------------|-------------|------|------------|------|----------|-----|----------|------|------------|-----|------------|-----|-------|
|                        | No.         | %    | No.        | %    | No.      | %   | No.      | %    | No.        | %   | No.        | %   |       |
| Food waste             | 4           | 19.0 | 5          | 29.4 | 6        | 30  | 5        | 29.4 | 3          | 30  | 2          | 10  | 23.8  |
| Vegetable waste        | 7           | 33.4 | 4          | 23.5 | 7        | 35  | 6        | 35.4 | 4          | 40  | 9          | 45  | 35.3  |
| Clothes                | 2           | 9.6  | 1          | 5.8  | 3        | 15  | 2        | 11.8 | 0          | 0   | 1          | 5   | 8.5   |
| Food packing materials | 6           | 28.5 | 5          | 29.5 | 4        | 20  | 2        | 11.8 | 2          | 20  | 7          | 35  | 24.7  |
| Medicines              | 0           | 0    | 2          | 11.8 | 0        | 0   | 1        | 5.8  | 1          | 10  | 1          | 5   | 4.9   |
| Others                 | 2           | 9.5  | 0          | 0    | 0        | 0   | 1        | 5.8  | 0          | 0   | 0          | 0   | 2.8   |
| Total                  | 21          | 100  | 17         | 100  | 20       | 100 | 17       | 100  | 10         | 100 | 20         | 100 | 100   |

\*Based on Sample Survey, July, 2019

In the Patliputra circle, the main contributor to household waste is food packing material, while in the rest of the circles, vegetable waste is the main contributor of solid waste (Table 3). Food waste is also a major contributor to household waste in Bankipur (30 per cent), Azimabad (29.4 per cent) and Patliputra circles (29.4 per cent). Food packing material, including plastic bottles which are popular among the students, now contributes a lot in solid waste of the city. Clothes and medicine do not contribute much as a part of household waste.

#### **Institutions in the Patna M.C. area:**

The present study also examined the composition of solid waste of different institutions. Five institutions were surveyed in the Patna Municipal Corporation area. In IGIMS, biomedical waste mainly comprises of discarded organs, broken glasses, syringes, rusted surgery blades and plastic bottles. Government offices like Sardar Patel Bhawan, Niyojan Bhawan and Vidyt Bhawan generate less amount of waste as compared to the medical institutions. Waste in the government offices, schools and colleges mainly consists of paper, food waste, plastic packing materials and sanitary napkins.

#### **Disposals of solid waste:**

The 'solid waste management' mainly concerns with dumping and managing the waste since the disposal of garbage at the right place and in a proper manner is very important for a clean and healthy living. From the survey, it was clear that many people dispose their household as well as institutional waste in the door-to-door municipal vehicle which is regular. The residents who are deprived this facility, throw garbage on the street or at any public place. Table 4 shows the disposal of solid waste by the sample households.

**Table 4. Disposal of Solid Waste by Household in the Patna M.C.Area\***

| Circles     | Public place |      | Door to door collection |      | On the street |     | Nala/water bodies |      | Total |     |
|-------------|--------------|------|-------------------------|------|---------------|-----|-------------------|------|-------|-----|
|             | No.          | %    | No.                     | %    | No.           | %   | No.               | %    | No.   | %   |
| New Capital | 0            | 0    | 20                      | 95.2 | 1             | 4.8 | 0                 | 0    | 21    | 100 |
| Patliputra  | 0            | 0    | 14                      | 82.4 | 1             | 5.9 | 2                 | 11.7 | 17    | 100 |
| Bankipur    | 1            | 5    | 18                      | 90   | 1             | 5   | 0                 | 0    | 20    | 100 |
| Kankarbagh  | 0            | 0    | 10                      | 100  | 0             | 0   | 0                 | 0    | 10    | 100 |
| Azimabad    | 2            | 11.7 | 15                      | 88.3 | 0             | 0   | 0                 | 0    | 17    | 100 |
| Patna City  | 2            | 10   | 15                      | 75   | 2             | 10  | 1                 | 5    | 20    | 100 |
| Total       | 5            | 4.8  | 92                      | 87.6 | 5             | 4.8 | 3                 | 2.8  | 105   | 100 |

\*Based on sample Survey, July, 2019.

It is clear from the table 4 that 92 per cent of the sample households dispose solid waste through door-to-door collection service. Only 4.8 per cent of them dispose them in the streets, 4.8 per cent in public places, 2.8 per cent in nala or water bodies. In Patna City, 10 per cent of the sample households dispose their waste on the streets, while their proportion is 5.9 per cent in Patliputra and 4.8 per cent in the New Capital circle. Parks are still a favourite spot of disposal of waste in Azimabad where 11.7 per cent of sample population dispose their waste. 11.7 per cent of sample households in Partliputra circle and 5 per cent in Patna City dispose their garbage in nala or water bodies. Thus, the survey clearly pointed out that waste is still dumped by households of Patna in public places.

**Collection of solid waste: Government initiatives :** The door-to-door collection of garbage is an excellent initiative started from 1-October 2018 by the Government of Bihar. The vehicles for collecting the waste in the Patna M.C area are provided with two bins each, one for biodegradable waste in green colour and other for recyclable waste in blue colour. But the residents of Patna in general are not aware of the separate bins and about their uses. In most cases, they throw their garbage in whichever bin they find suitable. This leads to the inappropriate disposal of waste.

Regularity of collection of solid waste by the vehicles in the Patna Municipal Corporation area as is evident from Table 5.

**Table 5. Regularity of Collection (in Percent) in Patna M.C. Area\***

| Circle       | Regular     | Not regular | Total      |
|--------------|-------------|-------------|------------|
| New Capital  | 90.5        | 9.5         | 100        |
| Patliputra   | 47.1        | 52.9        | 100        |
| Bankipur     | 80          | 20          | 100        |
| Kankarbagh   | 50          | 50          | 100        |
| Azimabad     | 70.5        | 29.5        | 100        |
| Patna city   | 65          | 35          | 100        |
| <b>Total</b> | <b>69.5</b> | <b>30.5</b> | <b>100</b> |

\*Based on sample survey, July, 2019.

It is clear from table 5 that door-to-door collection system is regular in most of the circles in the Patna M.C. area. In New Capital, Bankipur and Azimabad circle, the

service is quite regular (more than 70 per cent) whereas in Patna City (65 per cent) and Patliputra circle it is not regular (47.1 per cent) due to improper maintenance of the vehicle. The waste is dumped by the households in public places when the vehicle does not arrive on time.

**Segregation of solid waste:** ‘Segregation’ which generally means separation of things, is an important step in the management of solid waste, as it is important to categorize the waste into biodegradable and recyclable. Separation makes the process of solid waste management, more than just to dump all kinds of waste at any fallow land, without knowing about its proper consequence. Table 6 shows segregation of solid waste by households in the Patna Municipal Corporation area.

**Table 6. Segregation of Solid Waste by Households in The Patna M.C. Area\***

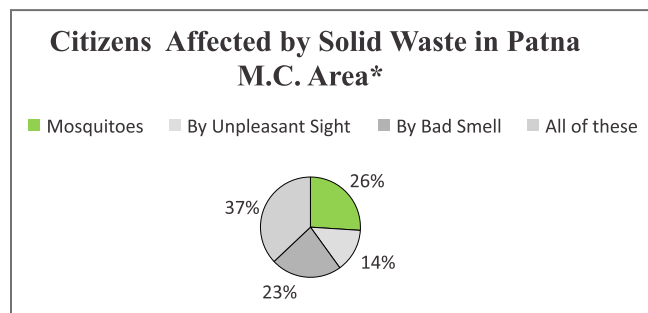
| Circles     | Segregate |      | Don't Segregate |      | Total |     |
|-------------|-----------|------|-----------------|------|-------|-----|
|             | No.       | %    | No.             | %    | No.   | %   |
| New Capital | 10        | 47.6 | 11              | 52.4 | 21    | 100 |
| Patliputra  | 6         | 35.2 | 11              | 64.8 | 17    | 100 |
| Bankipur    | 13        | 65   | 7               | 35   | 20    | 100 |
| Kankarbagh  | 6         | 60   | 4               | 40   | 10    | 100 |
| Azimabad    | 4         | 23.5 | 13              | 76.5 | 17    | 100 |
| Patna City  | 4         | 20   | 16              | 80   | 20    | 100 |
| Total (%)   | 43        | 40.9 | 62              | 59.1 | 105   | 100 |

\*Based on Sample Survey, July, 2019.

65 per cent of surveyed people segregate their household waste at the household level in Bankipur circle while it is as low as 20 per cent in Patna City circle (Table 6). 40.9 per cent of residents of Patna are aware of the role of segregation in solid waste management and segregate their household waste but most of them do not know about the importance of segregation at the household level.

**Impact of improper management on human health :** The solid waste management in any city plays a pivotal role in the health status of citizens. Improper disposal of solid waste can generate serious issues like pollution and epidemics. During the survey, it was clear that many people were suffering from health problems because of the improper management of waste. In many nooks and corners of the city, waste is dumped in public

areas, nalas or slum areas which brings along dangerous ailments like dengue, ataxia fever, asthma etc. Fig 7 show how local citizens are affected by deposition of solid waste in Patna M.C.



\*Based on Sample Survey, July, 2019.

Fig. 2

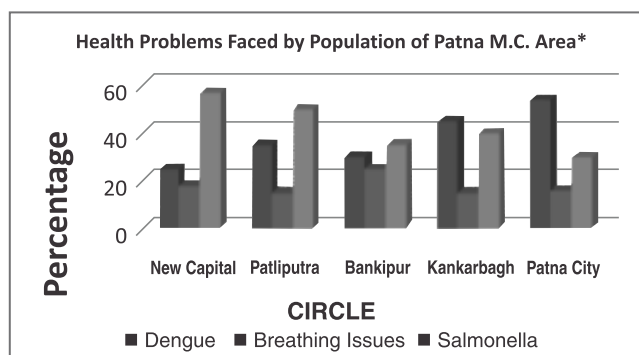
It is clear from Fig. 2 that 26 per cent of local residents are affected by mosquitoes, 14 per cent by unpleasant sites, 23 per cent by bad smell and 37 per cent by all of them. Solid waste dumps are breeding places of mosquitoes and are potential bearer of diseases like dengue, malaria, etc. The residents of Bairia village where solid waste is being dumped suffers the most and are selling their properties for bad smell and potential health hazards of the area.

Health problems faced by Patna M.C. residents is shown in fig 3 and table 7. Most of the residents faces the problem of Salmonella, commonly found in children occurs due to contamination of water and food. While 38.5 per cent of sample population faces dengue almost every year, food contamination is more prevalent in New Capital and Patliputra circle. Residents of Bankipur, Kankarbagh and New Capital circles suffer more from dengue fever.

Table 7. Health Problem Faced by Population of Patna M.C. Area\*

| Circle      | Dengue |      | Breathing Issue |      | Sale monella |      |
|-------------|--------|------|-----------------|------|--------------|------|
|             | No.    | %    | No.             | %    | No.          | %    |
| New Capital | 25     | 13.3 | 18              | 20.2 | 57           | 66.5 |
| Patliputra  | 35     | 18.5 | 15              | 19.8 | 50           | 61.7 |
| Bankipur    | 30     | 15.8 | 25              | 28   | 35           | 56.2 |
| Kankarbagh  | 45     | 23.8 | 15              | 19.8 | 40           | 56.4 |
| Patna City  | 54     | 28.5 | 16              | 17.9 | 30           | 53.6 |
| Total       | 189    | 38.5 | 89              | 18.1 | 212          | 43.4 |

\*Based on sample survey, July, 2019.



\*Based on sample survey, July, 2019

Fig. 3

**Management of waste :** The municipal authority is responsible for the collection, segregation, storage, transportation, processing and disposal of municipal solid waste. Every household and institution has its own method to manage the waste at their level. In Patna M.C. the management of waste is done in an obsolete manner.

**Households in Patna M.C. area:** The households of Patna M.C. area generally dump their garbage in door-to-door municipal vehicle, which transport all the household garbage to a landfill site. Only 5 per cent of sample households practice vermi-composting in small scale in their households. 20 per cent of households sell their old newspaper and plastic bottles for recycling purpose.

**Institutions in Patna M.C. area:** Institutions like schools, colleges, government offices, and hospitals developed their own units for the management of waste. The surveyed schools and college practice vermi-composting and incinerate the sanitary napkins, etc. On the other hand, the surveyed government offices did not manage their institutional waste properly. The surveyed hospitals have proper and well-developed management like they incinerate which is mandatory as per the current rule as well as they recycle their biomedical waste.

**Present Status :**

The present study of solid waste management in the Patna M.C. area mainly signifies positive initiatives taken by the Bihar government for collection of solid waste. A door-to-door collection system has been implemented successfully in most of the circles of the Patna M.C. area. The vehicle reaches on time in majority of places. The garbage and municipal tax is also taken from every household but not at regular intervals as few residents are willing to pay taxes.

**Failure of the Patna M.C. in managing solid waste :** The role of Patna M.C. in solid waste management cannot be undermined. Municipalities have overall responsibility for the solid waste management of their cities. The failure of solid waste management an embarrassment for the Patna M.C. It has resulted in serious health issues, environmental degradation, lack of sanitation and hygiene. Around 700 to 1,000 metric tonnes of garbage are collected from the city and its neighbouring areas every day, but the company has failed to treat the garbage properly. Currently, the Patna M.C. is working on proper collection of solid waste from households, but they are dumping it in landfill sites without managing it, which has become a source of land, water and air pollution of nearby localities and health hazards for residents.

Thus situation is dismal regarding management of waste. People generally throw their residue without segregating it. The green and the blue dustbins present in the Patna M.C. are particularly for wet and dry waste, but the locals dispose their waste in any bin as per their convenience. Due to lack of management at primary level, it affects the secondary level also, which leads to an all-inclusive improper management of waste. The landfill sites become source of foul smell and all pervasive unhygienic atmospheres and generate various waterborne and airborne diseases like malaria, dengue, typhoid, jaundice, etc. In comparison to other clean cities of the country, like Indore, Bhopal, Chandigarh, Visakhapatnam and Surat, Patna is the dirtiest capital which cannot segregate solid waste or generate electricity, fertilizers or use plastic in road construction etc. Failure to control water-logging due to the structure of the city and improper sewage system has worsened the situation. The current monsoon rain led to water-logging in Rajendra Nagar, Kankarbagh and Patliputra for days together which has further tarnished the image of the Patna M.C. and resulted into unhygienic atmosphere in the state capital.

**Measures for Improvement :**

- Motto of refuse, reduce, reuse, recycle should be introduced on a large scale.
- Plastic bags which are one of the biggest sources of pollution should be banned.
- Change in the habit of segregation which can change the approach towards waste management.
- Government should facilitate infrastructure creation for waste-to-energy plants.

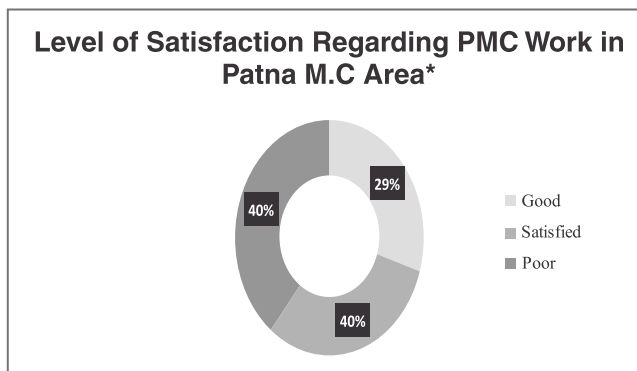
A sketch of possible measures for solid waste management is given below.



Source of the Fig. Firdoia & Pavnaskar, 2015, p.28.

**Fig. 4**

**Level of satisfaction among residents in the Patna M.C. area :** Level of satisfaction of people is an important requirement for the government when they implement any policy or scheme. For the current study, the level of satisfaction among people of solid waste management in their locality were surveyed.



\*Based on Sample survey, July, 2019.

**Fig. 5**

Fig 5 show the level of satisfaction among residents regarding PMC work in the Patna M.C. area, about the method of management used in Patna to keep the city clean. 40 per cent are not satisfied. According to them, the condition of management of solid waste is poor. Only 31 per cent are satisfied about the management of waste.

**Conclusion :**

The management of solid waste holds utmost importance in holistic development of the nation. Proper solid waste management is interrelated with sustainable

development and better quality of life of the citizens. The Patna M.C. is providing municipal and other civil services to 75 wards. The solid waste management system in Patna is not systematic and proper. Progressive growth in this regard is mainly due to door-to-door collection service from majority of household streets and institution, but in accordance with the management of waste, no proper step has been taken up till now. The Patna M.C. is just transporting the waste instead of managing it.

The management of waste includes creating the best out of the waste. It also includes proper dumping of waste according to their properties. Fig 5 shows the level of satisfaction among residents regarding management of solid waste in the Patna M.C area. It is shown that 40 per cent of residents are not satisfied with the work. The survey also indicates that residents are throwing garbage mostly in door-to-door collection without segregation shown in Table 6. The survey indicates that Patna municipality is currently dumping the waste in a Ramchak Bairia site without segregating at the secondary level. According to the officials of the Patna M.C., they will generate electricity, build roads from plastics, etc., from waste and also a segregation machine will be set up in the near future. But, at present, no concrete step has been taken in this regard. **Thus, it validates the first hypothesis that management of solid waste is not sufficient in Patna.**

Segregation plays an important role in dumping of solid waste. From Table 6 it is clear that 59.1 per cent of households do not segregate their waste which lead to improper disposal. 87.6 per cent households dispose their garbage in door-to-door collection and the garbage straightway goes to dumping site without getting segregated, which leads to soil pollution and many environmental problems since most of its part contains non-biodegradable items like plastic. **Thus, it validate second hypothesis that waste is dumped in non-segregated unorganised manner in the Patna M.C. area.**

26 per cent residents of Patna are affected by generation of mosquitoes/flies as indicated in Fig. 2 leading to health hazards like Salmonella shown in Fig 3. **Thus, it validate third hypothesis that unsafe disposal of solid waste in the city cause health hazards.**

The Patna Municipal Corporation has taken the first baby step towards the collection of waste and in some way it is successful, but it has a long way to go. In order to have a satisfactory, efficient and sustainable system of solid waste management, proper measures should be taken. Both micro and macro level planning are required to manage solid waste.

#### **Suggestions :**

- Generation of awareness about segregation of waste.
- Waste reduction at source.
- Mandatory standards and regulations.
- Mass education and voluntary compliance with business and consumers.
- Promotion of taxes and fees to effect source reduction.
- Recycling at household level.
- Donate things as much as possible.
- Maintain a balanced and eco-friendly lifestyle.
- Award for best performing ward.

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