International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 2 Feb 2022, pp: 217-225 www.ijaem.net ISSN: 2395-5252

A Review On Current Status Of Municipal Solid Waste Management In Karnataka State: A Geographical Study

Somashekhara* Dasharatha P. Angadi**
*Research Scholar, P.G. Department of Geography, Mangalore University, Mangalagangothri-574 199
** Associate Professor and Research Guide, P.G. Department of Geography, Mangalore University, Mangalagangothri-574 199

Submitted: 25-01-2022 Revised: 05-02-2022 Accepted: 08-02-2022

ABSTRACT: One of the world's most serious environmental challenges is solid waste. The rate of municipal solid waste trash generation in Indian cities is also increasing as a result of Industrialization, urbanization, and population growth. Mismanagement of municipal solid waste can have ramifications for the environment, public health, and another social and economic issue. Due to solid waste, people are getting health issues or medical problems and also its effects on the environment. Owing to the usage of electronics and other products, E-waste also contributes significantly to the overall flow. The potential risks to the use of electronic and other goods could be affected by such waste. This study attempts to review the current situation of solid waste management in Karnataka state, which can assist the component authorities responsible for municipal solid waste and research in developing more effective approaches. The following objective has been made to assess the current status of municipal solid waste management in Karnataka state, to know methods used for composting and landfilling of municipal solid waste in the state. The secondary data are used for analysis and simple statistical tools and techniques have been used.

KEYWORDS: Solid waste, mismanagement, health issues, hazards, municipal, etc.

I. INTRODUCTION

Urbanization, Industrialization, and a consumer-oriented society lead to rising levels of solid waste generation. With increasing urbanization, the amount of solid waste generated is multiplying. The type of waste also reflects the level of development of the society and its cultural attainment waste characteristics change according to season, income level, population, climate, and industrial production.

The scale of the waste materials and the degree of urbanization, recycling quality, and the reduction of jobs. The urban climate has become a significant topic of concern in recent years. Air, water, and soil contamination and the increasing amount of solid waste are the main environmental problems facing urban areas. One of the big issues facing city planners across the globe is urban solid waste management. In developing nations, the issue is more serious than in developed nations, as their economic development and urbanization are higher. The problem of municipal solid waste management in most developed countries is exacerbated by increased urbanization, inadequate planning, and a lack of sufficient resources. In the developed and developing world, the environmental issues and challenges of waste management are different. While developed countries produce significant quantities of waste, they have developed adequate facilities, components of government agencies, and bureaucracies to manage their waste. Developing countries are still in the process of improving waste management, but they currently have inadequate waste collection and inappropriate disposal. Generally, in a low-lying area, solid waste is disposed of without taking any precautions or operational control. One of the big environmental challenges facing Indian mega-cities is solid waste management. In general, municipal solid waste is a mixture of household and commercial refuse generated by the living population. Continued indiscriminate disposal of municipal solid waste is accelerating and correlated with poverty, poor governance, urbanization, population, low income, and lack of knowledge of the environment.

In 2002 there were290 crores urban population in the world who created about 0.64 kg of municipal solid waste/ person/day(70 crore tonnes per year). By 2012-2013 about350crore inhabitants were

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 2 Feb 2022, pp: 217-225 www.ijaem.net ISSN: 2395-5252

producing 1.4 kg/ person/ day (1.3-1.4 billion tonnes per year). By 2024-2025 this is an increase to 450 crore urban inhabitants producing 1.42 kg per day of municipal solid waste (240 crore tonnes/year.

Due to the lower availability of adequate facilities for the treatment and disposal of large quantities of solid waste produced daily in metropolitan cities, municipal solid waste management is in critical condition, scientific disposal of MSW produces a harmful effect on all components of the atmosphere and human health. Since there is a considerable difference in the nature of solid waste produced from different resources in the components, it is therefore very clear that their hazard potential would be at different levels. Industrial and hospital waste produces potent toxic compounds that are hazardous. For humans, livestock, and plants this waste could be highly toxic. India produces approximately several million tonnes of hazardous waste. India's hazardous waste generation has a direct proportion in terms of state or city growth and advancement and has shown considerable variation among Indian cities. As the country aims to achieve a developed nation status by the year 2020, the volume of solid waste is expected to increase significantly soon. 68 percent of waste in Karnataka remains untreated as per the data accessed by the Central Pollution Control Board (CPCB) and the Ministry of Housing and Urban Affairs (MoHUA). If solid waste processing is considered in the urban area. The state has the worst record in south India. The data revealed that as of January 2019 Karnataka generates 10,000 tons of waste every day out of which only 3,200 tons of waste (32 percent) was processed. West Bengal, Orissa, and Jammu & Kashmir are the only major states which lesser waste than Karnataka. Urban Development Department of Karnataka said that the quality of waste processing is much better than in other states. The segregation at source is one of the best in India and the model used to create compost is better than other states.

STUDY AREA

Karnataka state is situated in the southwest part of India and Karnataka is the 6th largest state in India. The study area is located in 11°30' N and18°30′N latitudes and 74°00'E and 78°30′Elongitudes. The state is having major rivers, namely Kaveri, Krishna, Malaprabha, Ghataprabha, Tungabhadra, Netravati, and Sharavathi rivers. The state has 2 international airports at Bangaluru and Mangaluru. The state shares boundary with the Arabian Sea on the west, Tamilnadu on the east, Maharashtra on the north, Kerala on the south, and Telangana andAndhra Pradesh on the northeast. Karnataka is the fastest-growing state in education, commerce, industries, and Information Technology. The capital city of Karnataka is Bangaluru, the Bangaluru is the IT Capital of India, and also it's called as SiliconValley of India. The state with more than 6 crore population facing the problem of solid waste management too.

II. METHODOLOGY

The first part of this study involves the calculation of the amount of waste produced, the total output of solid waste, the collection of waste, and the disposal of waste in Karnataka. It also concentrates on the disposal and landfilling of solid waste management.

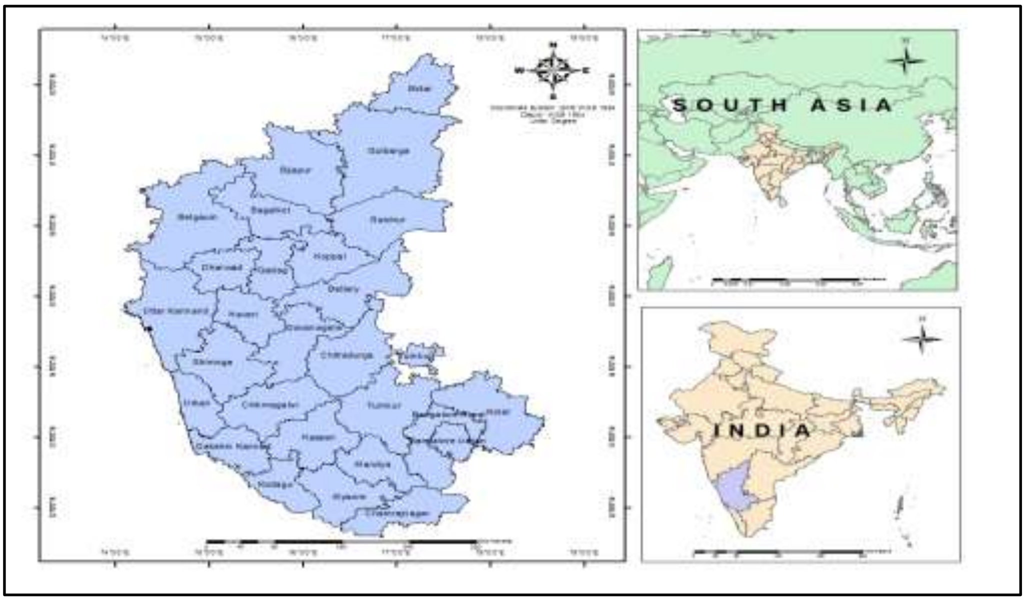


FIGURE NO. 1: STUDY AREA

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 2 Feb 2022, pp: 217-225 www.ijaem.net ISSN: 2395-5252

III. DISCUSSION

The volume of solid waste and its characteristics vary from area to area. The average level of income, population sources, social behavior, environment, industrial production, and the demand for waste materials are factors affecting quantity and composition . The current annual amount of solid waste produced in Karnataka cities has increased from 2,200 tonnes in 2000, 3,900 tonnes in 2005, 5,700 tonnes in 2010, 8,800 tonnes in2015, and 10,000 tonnes in 2019, respectively.

In table no.1 we can observe the total population, area km^2 and population density per km^2 of the districts in Karnataka. Some cities are having high populations(Bengaluru, Belagavi, Mysore, Tumkur, Kalaburgi, Ballary, Vijayapura, and Dakshina Kannada).

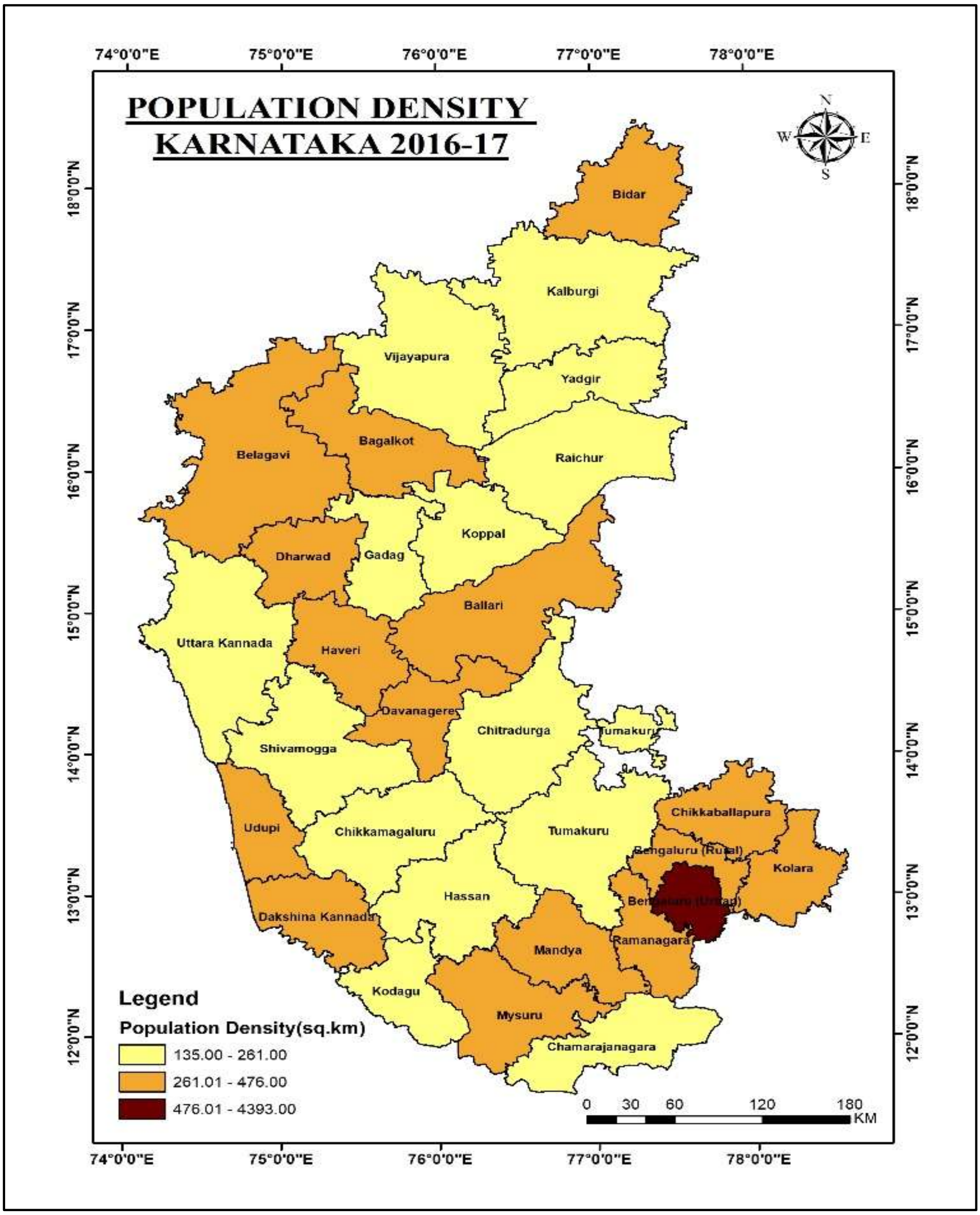
Table no. 2 reveals that, the waste generation, waste collection, waste processed and waste disposal is high in some district (Bengaluru urban, Dharawada, Kalaburgi, Ballary, Belagavi, Dakshina Kannada, and Gadag). Due to the rapid economic growth and the increased degree of urbanization in these towns are attributed to high living standards. However, in other districts waste production is found to be low because of less population concentration (Raichur, Tumkur, Bangalore rural, Chamarajanagara, Hassan, Bidar, and Kodagu).

TABLE 1: LIST OF DISTRICT-WISE POPULATION, AREA KM^2 AND POPULATION DENSITY IN KARNATAKA STATE.

SL. NO	District name	Total population	Area (Km^2)	Population density/Km^2
1	Bangalore Urban	96,21,551	2,190	4393
2	Belagavi	47,79,661	13,415	356
3	Mysore	30,01,127	6,854	476
4	Tumakur	26,78,980	10,597	255
5	Kalaburgi	25,66,326	10,951	234
6	Ballary	24,52,595	8,450	290
7	Vijayapura	21,77,331	10,494	207
8	Dakshina Kannada	20,89,649	4,560	430
9	Davanagere	19,45,497	5,924	328
10	Raichur	19,28,812	6,827	228
11	Bagalakote	18,89,752	6,575	288
12	Dharawada	18,47,023	4,260	434
13	Mandya	18,05,769	4,961	364
14	Hassan	17,76,421	6,814	261
15	Shivamogga	17,52,753	8,477	207
16	Bidar	17,03,300	5,448	313
17	Chitradurga	16,59,456	8,440	197
18	Haveri	15,97,668	4,823	331
19	Kolara	15,36,401	3,969	386
20	Uttara Kannada	14,37,169	10,291	140
21	Koppal	13,89,920	7,189	250
22	Chikkaballapur	12,55,104	4,524	296
23	Udupi	11,77,361	3,880	329
24	Yadagiri	11,74,271	5,273	223
25	Chikkamagaluru	11,37,961	7,201	158
26	Ramanagara	10,82,636	3,556	308
27	Gadag	10,64,570	4,656	229
28	Chamarajanagara	10,20,791	5,101	181
29	Bengaluru Rural	9,96,923	2,259	431
30	Kodagu	5,54,519	4,102	135
	Total	6,10,95,297	1,91,791	

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 2 Feb 2022, pp: 217-225 www.ijaem.net ISSN: 2395-5252

SOURCE: KSPCB (2016-2017)



FIG, NO.2 POPULATION DENSITY OF KARNATAKA

TABLE 2: SOLID WASTE GENERATION STATUS IN KARNATAKA STATE.

Sl. No	Name of the district	Solid waste generation (in TPD)	Solid waste collection (in TPD)	Solid waste processed (in TPD)	Solid waste disposal (in TPD)
1	Bengaluru Urban	5,772	5,171	2001.5	1946

2	Belagavi	793.55	473.47	259	242.62
3	Mysore	92.57	80.02	29.22	53.6
4	Tumakur	30	29	8	23
5	Kalaburgi	359.37	301.93	13	263.78
6	Ballary	354.32	313.5	28.83	245.8
7	Vijayapura	179	147	15	130
8	Dakshina Kannada	378.99	368.49	268.5	148.99
9	Davanagere	224.19	210	122	159
10	Raichur	13.52	13.11	0	8
11	Bagalakote	192.9	169	62.5	66
12	Dharawada	438.34	389.5	10.5	373.53
13	Mandya	122.75	114.55	15	76.55
14	Hassan	143	131.6	61.5	57
15	Shivamogga	235.3	213.5	156.7	160.11
16	Bidar	155	131.5	34	93.5
17	Chitradurga	165.3	97.7	22.2	96.7
18	Haveri	169.2	156.7	54.6	109.7
19	Kolara	191.41	152.37	21.5	182.37
20	Uttara Kannada	144	135.5	15	110.5
21	Koppal	119	104.5	24	81.5
22	Chikkaballapur	32	98.16	43	31.16
23	Udupi	112.84	106	102	40
24	Yadagiri	179.5	57.5	0	49.5
25	Chikkamagaluru	96.6	93.3	13.2	84.63
26	Ramanagara	126.5	104	11	99
27	Gadag	359.37	301.93	13	263.78
28	Chamarajanagara	79.09	68	10.5	56
29	Bengaluru Rural	122	107	20	49
30	Kodagu	21.5	49.33	3.7	37.63
	Total	**11,186**	**9,706**	**3,475**	**5,170**

SOURCE: KSPCB (2016-2017)

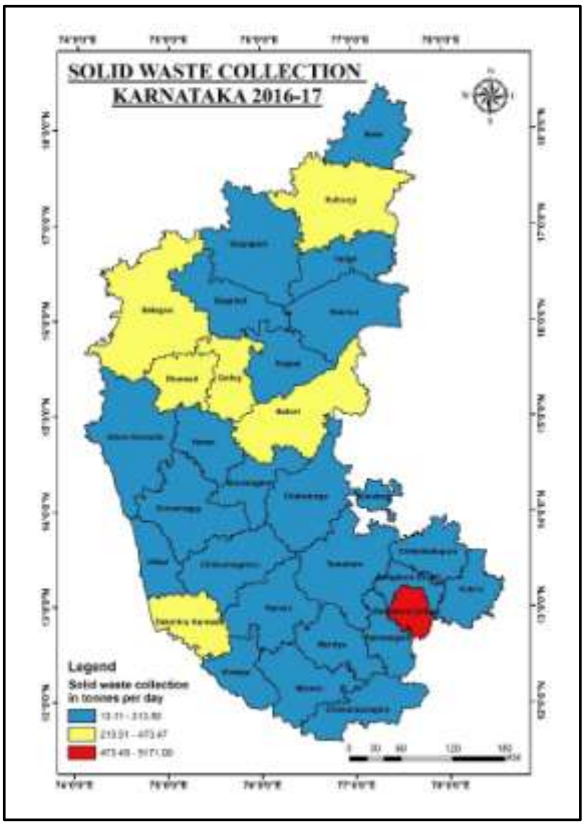
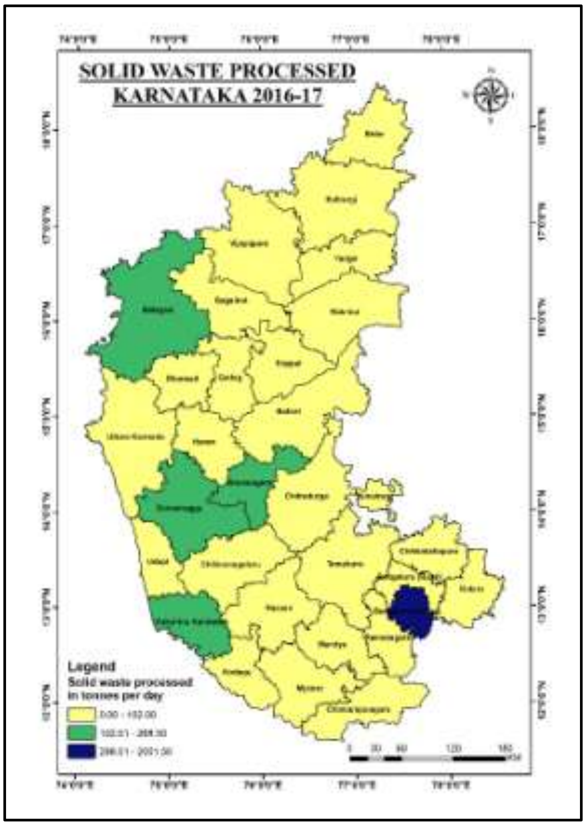
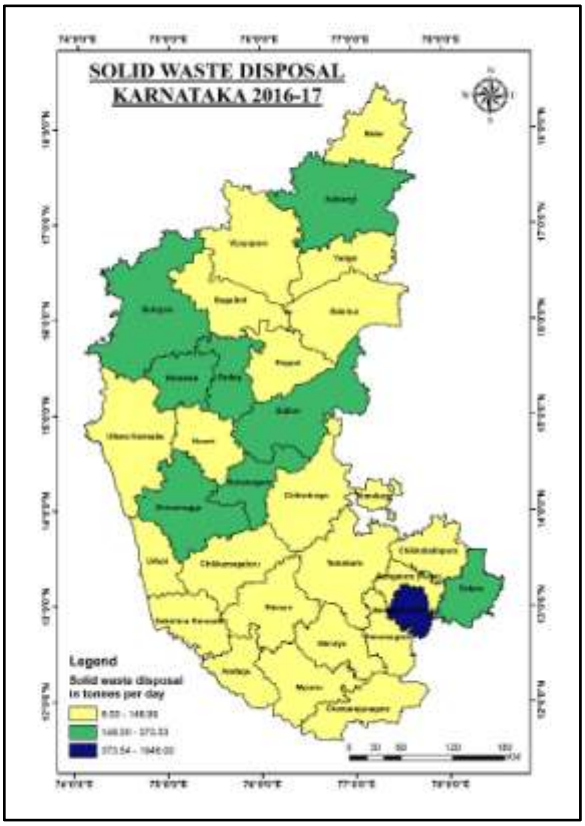


FIG.NO 3 SOLID WASTE GENERATION





International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 2 Feb 2022, pp: 217-225 www.ijaem.net ISSN: 2395-5252

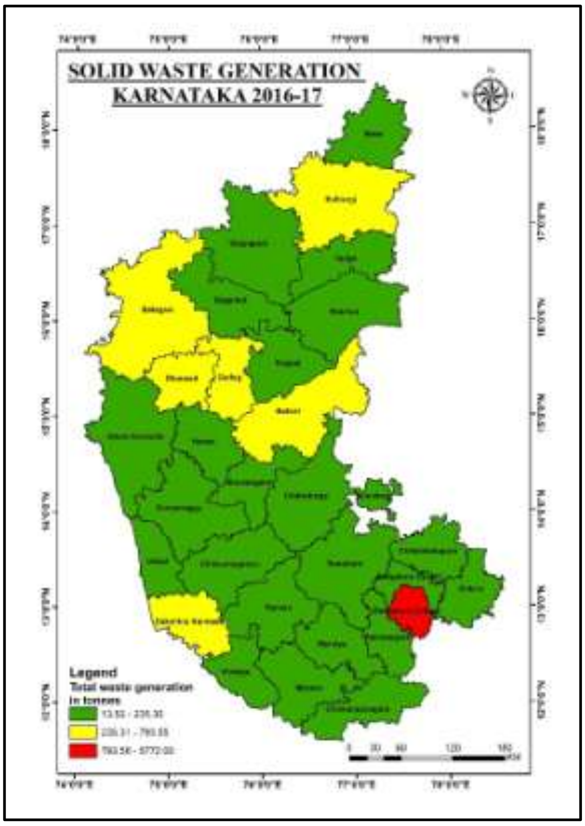


FIG.NO 4 SOLID WASTE COLLECTION
FIG.NO 5 SOLID WASTE PROCESSED
FIG.NO 4 SOLID WASTE DISPOSAL

According to 2011 census, the population of Karnataka is 6,10,95,297. The state is distributed over an area of approximately 1,91,791sq. km. The government of Karnataka upgrades some TMCs to CMCs, TPs to TMCS, during 2015 and 2016 and created some additional TPs based on their population, thereby creating an additional 59 urban local bodies to the current list.

TABLE NO. 3: NUMBER OF LOCAL BODIES

SL.NO	Bruhath Bengaluru Mahanagara Palike	1
1	City Corporations	10
2	City Municipal Council	58
3	Town Municipal Council	115
4	Town Panchayats	89
5	Notified Area Committee	4
6	**Total**	**277**

COMPOSTING AND LANDFILL OF MUNICIPAL SOLID WASTE

Composting is also a method of treatment under the Municipal Solid Waste Rule 2000. Other technologies, such as incineration and palletisation, can also be employed in appropriate situations. However, municipal authorities or operators who seek to use cutting-edge technologies must first achieve CPCB-specified standards before requesting the license. Landfill sites are developed under the MSW rules 2000. The quality of leachates must meet the MSW rules 2000 requirements.

1. <u>COMPOSTING</u>

Composting would be the treatment and processing method for municipal solid waste, according to solid waste management policy. Currently, there are worries over the sale of compost. It has been proposed that incoming waste be composted using an aerobic composting approach to render the waste inert. If there were a market for compost, the inert waste would be sieved and the compost sold, while the rejects would be landfilled. Vermicompost has a small market yet high price. It is suggested that the partially digested aerobic compost can be transformed to Vermicompost depending on the requirement. The sieve system and Vermicomposting are the technologies proposed for aerobic composting for interstation.

1.1 AEROBIC COMPOSTING

The waste that is produced and received at the processing site is aerobically composted. This composting method distributes the inert waste. Placing the waste onto windrows was included in the aerobic composting process. Windrows are long heaps of waste shaped from 2.5 to 3 meters in a trapezoidal shape with a base height of 5 meters. The dimensions vary depending on the amount of garbage to be handled each day. The windrows are situated on a specifically constructed concrete base. The windrows are turned every 6-7 days over 6 weeks. The garbage is turned by using the loaded front end. Following that, the content would be placed under shelter for a total of one week. During this process, the material is stabilized with correct turning, the addition of microbial cultures, such as cow dung slurry or specific culture, will speed up the degradation, and the stabilization process can be completed in 30days. This stabilized material can be disposed of in landfills.

1.2 VERMI COMPOSTING

Earthworms devour partially digested garbage and provide excellent manure casting. Vermicomposting entails feeding the worm and extracting the casting to be used as agricultural manure in conjunction with an organic fraction of municipal garbage.On partly decomposed waste, the earthworm eats. To ensure partial decomposition, the incoming urban waste must be composted aerobically for approximately 2 to 3 weeks. The earthworms are supplied with partially decomposed waste. The earthworms would eat the waste and over 4-6 weeks convert them to casting. At regular intervals, the cast must be collected manually. Earthworms need shade and protection from predators and rain. To store the partially decomposed waste and worms, a pit above ground is favored. The pits must be shielded from the sun and rain to give protection. The inorganic trash that the worms do not consume is disposed of in a landfill, while the organic waste is returned to the worms. The adult worms and baby worms from each cycle are collected again and again in the following cycle.

2. <u>LANDFILL</u>

The rejections from the process of composting have to be filled with the land. It is suggested that a sanitary landfill for class 1 town should be created. It is recommended that a sustainable development approach to waste management be implemented for smaller metropolitan local authorities with lower waste generation. It is suggested that for all waste, engineered landfill construction will take place. Treatment and enhanced landfill practices will be gradually enforced. Here is the comprehensive development needed for the sanitary landfill and the engineered landfill.

2.1 SANITARY LANDFILLS

The approach toward sanitary landfills is based on the 2000 MSW rules. The landfill is based on the principleof landfill separation from surface water and waste containment inside the landfill. This will include the construction of the landfill site with sufficient road access to the basic infrastructure, gatehouses with weighbridge, building with record rooms and storage, washing and toilet facilities for workers. For the separation of waste from surface runoff and the containment of waste, the proper landfill must be built to protect against leachate movement directly to the earth. It would be provided with a liner system with leachate collection. A facility for leachate treatment will also be provided. The waste will be tipped to a schedule and covered every day. It will prepare for monsoon waste placement. A cover liner will be supplied until the expected waste levels are reached. With a 20-25 year view, the landfill will be built. A comprehensive implementation plan will be drawn up before an investment.

2.2 ENGINEERED LANDFILL

The method of a progressive upgrade of the integrated solid waste management facility will be based on the engineered landfill. In the constructed landfill, the key principle is to separate the waste from surface runoff to ensure that the water entering the waste is minimized and the output of constitute leachate is minimized. Initially, the landfill site must be built such that all the rainwater from outside the site would not reach the planned landfill area by constructing suitable surface drains. From the landfill, two approaches are suggested based on the prevailing soil situation. If the soil consists of hard laterite or is rocky and if drilling is not advisable, it is recommended that the waste management landform approach be adopted. A pit-based waste management system would be adopted where it is possible to excavate the soil.

IV. CONCLUSION

An attempt has been made in this paper to research the pattern of solid waste generation, collection, recycle and waste disposal. The evolving trend of waste composition highlighted the importance of segregation for waste treatment facilities to function effectively. The storage facilities should be managed by local authorities in such a way that they do not establish unhygienic conditions. A new survey on the generation and classification of municipal solid waste in Karnataka should be undertaken.

REFERENCE

[1]. Arvind, k, Jha. S, K, Singh. G, P, Singh. And Prabhath, K, Gupta. (2011): Sustainable municipal solid waste management in low income group of cities: A review. International Society of Tropical Ecology. Vol. 52(1), pp. 123-131.

[2]. Davis, M. L., and Cornwell, D. A. (1998): Introduction to environmental engineering, McGraw-Hill Education.

[3]. Gupta, S., Mohan, K., Prasad, R., Gupta, S., & Kansal, A., (1998): Solidwaste management in India: options and opportunities.Resource. Conservation. Recycle. vol. 24 (2), pp. 137–154.

[4]. Hoornweg, Daniel; Bhada-Tata, Perinaz. (2012): What a Waste: A Global Review of Solid Waste Management. Urban development series; knowledge papers no. 15. World Bank, Washington, DC. © World Bank.

[5]. Kalpana Markandey (2020): Solid waste management: A case study of Hyderabad, The Indian Geographical Journal. vol. 95 (1). pp. 1-21.

[6]. Karnataka State Pollution Control Board. (2017)

[7]. Karnataka Urban Infrastructure Development and Finance Corporation report.

[8]. Late, A. and Mule, M, B., (2013): Composition and characterization study of solid waste from Aurangabad city. Univ. J. Environ. Res. Techno. 3(1), 55-60

[9]. Neha Gupta., Krishna Kumar Yadav, and Vinit Kumar. (2014): A review on current status of municipal solid waste management in India, J. environ.sci.

[10]. Ogwueleka T. Ch., (2009): Municipal Solid Waste Characteristics and Management in Nigeria, Iran Journal of Environmental Health. Science and Engineering, Vol. 6, pp. 173-180

[11]. Rachel, O.A., Komine, H., Yasuhara, K., & Murakami, S., (2009): Municipal solid waste management in developed and developing countries - Japan and Nigeria as case studies.

[12]. Raj Kumar, N., Subramani, T., & Elango, L., (2010): Groundwater contamination due to municipal solid waste disposal- A GISbased study in Erode City. International Journal Environment science vol. 1(1) pp. 39-45.

[13]. Rathi, S.,(2006): Alternative approaches for better municipal solid waste management in Mumbai, India. J. Waste Management. vol. 26 (10), pp. 1192–1200.

[14]. Sandipta Das. And D.P. Angadi. (2018): Site Suitability Analysis for Municipal Solid Waste Disposal in Mangalore City Corporation, Karnataka - Using Geospatial Technology, International journal of science and research (IJSR), vol .7(3), pp. 1717-1724.

[15]. Sharholy, M., Ahmad, K., Mahmood, G., Trivedi, R.C. (2008): Municipal solid waste management in Indian cities-A review. Waste Management. Vol. 28(2), pp. 459- 467.

[16]. Sharma, S., Shah, K.W. (2005): Generation and disposal of solid waste inHoshangabad. Proceedings of the second International congress of Chemistry and Environment, Indore, India. pp. 749-751.

[17]. Swacch Bharath Mission, Municipal solid waste management manual (2016)