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CURRENT EVALUATION OF BIODEGRADABLE WASTE FROM HOUSEHOLDS: A CASE STUDY OF MOKOKCHUNG, KOHIMA, AND DIMAPUR TOWN

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ABSTRACT

One of the most important environmental problems of urbanization and population growth is the amount of the Solid waste that is generated at a rate that surpasses the ability of the natural environment to accommodate or the authorities to manage it. Ignorance of government, the inadequate policy adopted by the concerned authority, and lack of knowledge regarding solid waste in the public domain have led to poor management of solid waste in the study areas. The present data have been collected through a field survey using experimental research. The main objective was to find out the quantity of biodegradable waste entering the main solid waste stream and to analyse the best way to reduce biodegradable waste at the ground level. The result suggested that about 43 % of the waste entering into Municipal solid waste is biodegradable in nature. The Biodegradable waste generated in three districts were recorded in Mokokchung (45%), Kohima (42%), and Dimapur (41%) towns annually. In conclusion, biodegradable waste can be decomposed naturally this means that if segregation is done properly at the source level along with the right programme and policy 43% of the waste can be decomposed naturally thereby, reducing the pollution level from solid waste.

***Index terms*: Pollution, Segregation, Study field, Biodegradable, Management**

I. INTRODUCTION

Biodegradable waste is a type of waste, originating from plant and animal sources, which can be degraded by other living organisms. Biodegradable waste includes any organic matter in waste which can be broken down into carbon dioxide, water, methane, or simple organic molecules by micro-organisms and other living things by composting, aerobic digestion, anaerobic digestion, or similar processes (White, 2017; R, 2021).

Mokokchung is a municipal town in the Mokokchung district in the state of Nagaland. It is the district headquarters and the main urban hub of Mokokchung district. It lies between 26°17'59.89″ and 26°20'24″ N Latitude and 94°29'59.96" and 94°32'24" E Longitude. Mokokchung town is the cultural nerve center of the Ao people and is economically and politically the most important urban center in northern Nagaland. It is one of the most important urban hubs in all of Nagaland after Dimapur and Kohima. The town limit/municipal area covers an area of about 7 sq. km and is divided into 18 wards. Dimapur town is located in the geographical coordinates between 25°53'19.81″ and 25°55'15.19″ N Latitude and 93°42'15.24″ and 93°45'9.93″ E Longitude. Dimapur is the largest city as well as the commercial capital of Nagaland, with a plain terrain, having excellent road, rail, and air links with various parts of the country. It is considered the gateway to two North-Eastern States of Nagaland and Manipur. The city is the administrative headquarters of Dimapur district. The Dimapur Council, whose ambit and jurisdiction covers a population of 122,834 and an area of 18.13 sq. km, respectively, has been playing host to, as well as, managing the resultant waste problems. Kohima is the capital city of state of Nagaland. With a population of almost 100,000, it is the second-largest city in the state. Kohima town is located in the geographical coordinates between 25°38'25.72″ and 25°42'36″ N Latitude and 94°4'47.71″ and 94°8'23.57″ E Longitude.

In the study areas residential, commercial, institutional, and municipal services are the four major sources of solid waste. Compare to other sources of solid waste residential places generate a significant amount of solid waste in urban areas. The reason behind this is that there are more residential places in any settlement; the case is no different from the present study areas. There are 8906, 22312, and 27165 households in Mokokchung, Kohima, and Dimapur town respectively (2019). Residential places occupy 50 per cent of study areas. The amount of waste generated in Mokokchung, Kohima, and Dimapur town is 40, 70, and 120

metric tons per day out of this 52 per cent of the waste in the study areas is from residential areas. The study shows that 50, 57, and 48 per cent of waste in Mokokchung, Kohima, and Dimapur Towns is from residential areas. Households often generate large quantities of biodegradable waste in the form of kitchen and garden waste. In the study areas, biodegradable waste (kitchen waste + green garden waste) represents more than 43 per cent of all domestic waste. These wastes end up either in landfills or drainage systems. In a landfill biodegradable waste is mixed with other types of waste, this produces harmful gas like methane gas which is known to damage the atmosphere more than CO_2. High per capita biodegradable waste generation from households enhanced by inadequate management of solid waste disposal is a real concern in the study areas. The present paper is an attempt to suggest a suitable way to overcome such a menace.

The objectives of the Study are:

1. To examine the quantity of biodegradable waste entering the main solid stream from households
2. To suggest a suitable strategy for the reduction of biodegradable waste at the household's level.

II. DATA AND SOURCE OF DATA

The present study is based on both primary and secondary data. Secondary data has been collected from document/literature review, journals, published and unpublished government reports. Primary data has been collected from interviews, surveys, questionnaires, experiments, and observations. The census which consists of total population, households, etc., has been collected from the three Municipal Councils i.e., MMC, KMC, and DMC (2019).

III. RESEARCH METHOD

Field research for households was conducted to determine the composition of solid waste (SW) for all three study areas. 25 houses were selected randomly from five wards and dustbins were distributed in green, blue, and red dustbins and it was observed for a period of one year 2019-2020. Sample for the solid waste were taken every month for 25 households from the study places i.e., Mokokchung, Kohima and Dimapur towns which amount to a total of 75 households. Green bins were allotted to collect compostable material like kitchen waste, green waste, etc. Blue bins were allotted to collect recyclable material like plastic, paper, cardboard; woodchips, sawdust etc., and red dustbins were allotted to collect inert material like fine earth, ashes, Silt, pebbles, etc. Sorting and weighing of solid waste were done manually using a normal weighing machine.

IV. FINDING AND DISCUSSION

From table 1 we see that biodegradable waste accounted for most of the waste followed by paper and cardboard, for Mokokchung town the biodegradable waste accounted for 6854 kg which forms 45 per cent of the total waste followed by paper and cardboard waste which formed the 2nd most waste generated with 1409 kg which is 9 per cent of total waste. In Kohima town 5520 kg of waste were biodegradable waste which accounted for 42 per cent of the total waste, paper and cardboard waste formed 1342 kg which is 10 per cent of total waste and lastly, Dimapur town the weights of biodegradable waste were 6224 kg which is 41 per cent of the total waste generated from households.

Table 1: Physical analysis of solid waste in Mokokchung, Kohima, and Dimapur town from households. To be noted (W stand for waste, P&C stands for paper and cardboard, and A.W.G stands for annual waste generation)

Mokokchung Town			**Kohima Town**		**Dimapur Town**	
Type of waste	**A.W.G kg**	**W (%)**	**A.W.G Kg**	**W (%)**	**A.W.G Kg**	**W (%)**
Biodegradable	6854	45	5520	42	6224	41
P & C	1409	9	1342	10	2153	14
Plastics	468	3	790	6	1232	8
Metals	307	2	364	3	920	6
Glass	244	2	484	4	1446	10
Bio-resistant	245	2	276	2	1617	11
Inert	5335	35	4051	31	1201	8
Others	452	3	338	3	317	2

Source: Field survey (2019 -2020).

Paper and cardboard waste in Dimapur consist of 2153 kg which forms 14 per cent of total waste. The field research reveals that biodegradable waste generated for a year from households accounted for 45 per cent, 42 per cent, and 41 per cent of the total waste in Mokokchung, Kohima, and Dimapur town. The result suggests that 43 per cent of total solid waste entering into the main Municipal solid waste (MSW) stream is biodegradable waste. Biodegradable waste is further divided into three category fruit waste, leftover food, and vegetable waste. According to the finding after biodegradable, the 2nd most generated waste from households is paper and cardboard and can be counted as part of biodegradable waste since it is decomposable as well through composting. Paper and paper product like cardboard is usually made from plant-based sources and comes from renewable farms and as such will biodegrade naturally through composting like aerobic composting. Instead of throwing paper away, use it for the compost. The paper breaks down over time except that there is time variation for paper decomposition. Mixing items like banana peels, bread, and strawberries, which mould quickly, with the paper it increases the rate of decomposition. Worms will also make the process faster (Fleming , 2021).

Segregation is one of the most important activities that we need to promote and enforce for effective waste management in the study areas and to make landfills reduce in size gradually (Dubey, 2018). Storage of waste is practised in all the three study areas what is lacking is source segregation. According to data 90 per cent of the population disposes of their wastes without any kind of segregation either they dump in drainage or community dustbin. All the three Municipal council has introduced door to door collection except for Mokokchung which covers only six wards of door-to-door collection on a trial basis. In all these areas some sort of source segregation has been introduced by the authority but the policies, approaches, and methods adopted are inadequate this may be due to a lack of knowledge about solid waste and its problem among the local bodies and public. Segregation of waste at the source level should be encouraged and enforced as per the new MSW rules 2016. Another problem facing these areas is that even if the people do source segregation at the source level but get mixed up in the collection vehicle along the route, there is no point in doing source segregation. The data shows that the vehicle used for collecting and transporting solid waste are open trucks which by design is not meant for collecting solid waste.

So now what we need is to build capacity at the municipal level to enforce and implement source segregation. In the study areas educating people to do source segregation at home will take time. For now, if needed, we should also look at the options of doing segregation at a central facility (Dubey, 2018). Separated waste is needed and it should be clean enough for effective waste treatment technology. For example, the compost plant should get only the biodegradable, organic, fraction of the waste to produce good compost which will meet regulatory standards and can be used in agricultural and other applications. The compost plants can sell the compost in the market to generate revenue for running the compost plant. Segregation of waste and composting for biodegradable waste (well in this case any waste to energy technology) should go hand to hand. Solid waste becomes a major problem when biodegradable waste and non-biodegradable waste get mixed. Mixed waste leads to higher residual percentages in the waste-to-energy plants, and that takes a hit on the financial and other resources in the treatment facility (Dubey, 2018). According to Dubey, 2018 in Western Europe, the average residue at mass-burn incinerator is around 10% but in Indian conditions, it is 30%. This is mainly due to a mix of waste streams.

V. CONCLUSION

The result of the research shows that not only is it possible to segregate solid waste at the household level but it also shows that 43 per cent of biodegradable waste entering the main solid waste stream can be reduced at the household level thereby it can reduce the size of landfill and environmental problem related with unscientific landfill. Through composting this biodegradable waste can be turned into fertilizer and soil conditioner so, along with reducing biodegradable waste at the household level, it can be used in agricultural and other applications. The study has successfully generated a data set showing potential of reducing biodegradable waste at the household level. The study concludes that the household sector should strive to be environmentally friendly by reducing solid waste generation, segregation of solid waste in households, and ensuring proper waste disposal practises. Government, experts, scholars, and public leader has a huge role to be played in spreading education and awareness among the general public and it's very important to implement solid waste reduction strategies in this study area.

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