## **Research Paper**

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# "BIOMAG - Community Based Solid Waste Management through Re-Cycling and Up-Cycling In an Adopted Ward Of Corporation of Kochi, Kerala, India."

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**ABSTRACT:-** The BIOMAG project was aimed at creating awareness among the public particularly the residents of ward VII of Kochi Corporation about the need to manage plastic waste properly. A consumer state like Kerala has a high per capita generation of plastic waste. This is particularly true in a city like Kochi. The project was perceived as relevant by the Department of Zoology of The Cochin College because of the coastal proximity of Kochi Corporation. Domestic plastic waste that is not managed properly will invariably find its way to the ocean through the storm-water drains and other public dumps especially during the rainy season. Thus it will become a threat to various species of marine life. On land also the dumps and litter lying around results in other threats to animal life through ingestion by birds, cows and other animals. Leaching from dumpsites like Brahmapuram leads to the contamination of ground water by additives and synthetic dyes used as colouring agents.

The Department of Zoology of The Cochin College took up this project as an Outreach project that can be steered by the students of the department under the guidance of the teachers. The main tasks of awareness creation and sensitization about the need to dispose plastic waste properly was undertaken by the students and teachers through door to door visits to the households of the ward and one on one explanation to the residents. Public activities like street plays and skits were also planned to spread awareness. Workshops were conducted on other methods to manage plastic waste such as reduce, reuse and refuse. Do It Yourself (DIY) workshops were also conducted for the public on how to make their own shopping bags from used clothing. Workshops were also conducted on how to do home composting of kitchen waste. The Project was not only aimed at giving awareness and sensitizing the target group about reduce, reuse and refuse strategies but went one step further in offering recycling solutions as well. It was fully understood that despite reduce, reuse and refuse strategies there is inevitably generation of plastic waste in every household particularly due to the fact that every item of food and grocery, from food grains to soap, comes in plastic packaging. Hence it was imperative that for the project to have an impact, recycling options too have to be provided to the public. For this purpose, the Department of Zoology engaged a reliable agency that has considerable experience in the field of door to door collection of plastic waste, followed by grading and finally dispatch for recycling. The agency selected for this was PlanatEarth a non-profit agency based in Aluva.

The recycling solution that was offered to the target community proved to be the main aspect of the project for the public was offered both strategies to reduce the per household generation of waste as well as a way to ensure that whatever plastic waste that is still generated gets collected and recycled. Total 5547 kg of plastic waste has been removed. Some non –recyclables have to be despatched to cement manufacturers for use as RDF. This process incurs charges.

Keywords:- Kochi, Solid waste management, Plastic wastes, Community based

I.

## INTRODUCTION

**Kochi**, (9.97°N 76.28°E) cosmopolitan city in Kerala and major port on the Malabar Coast of the Arabian Sea, west-central Kerala state, southwestern India. Also the name of a former princely state, "Kochi" is sometimes used to refer to a cluster of islands and towns, including Ernakulam, Mattancheri, Fort Cochin, Willingdon Island, Vypin Island, and Gundu Island. The urban agglomeration includes the localities of

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Trikkakara, Eloor, Kalamassery, and Trippunithura. Kochi is the financial and commercial capital of Kerala and, with a population of more than 2 million, the biggest conurbation in the state.

Kochi city is the second most important city next to Mumbai on the western cost of India. Cochin Corporation has an area of 94.88 sq.km. and is divided into 66 wards (administrative division). Kochi is the most urbanized region in Ernakulam district. As per census of India 2001, the population of Kochi Corporation is 5,95,575. Physical, social, political and economic factors have played their decisive role in the formation of land use pattern in Kochi city (Figure 1 & 2). The characteristic feature of the central city is the predominance of the area under water. The water sheet consists of backwaters, rivers, canals, tanks and ponds and altogether it forms 23.4% of the green land of the city. The net dry land available for urban use amounts to 71.86% of the gross land i.e. 68.18 sq. km. Actually there could be no ideal location than this, with its protected lagoons directly accessible from the sea, for a major terminal port and with its locality copiously blessed by nature for a concentration of urban population and activities.

But the present pattern of the city can be classified as that of haphazard growth with typical problems characteristics of unplanned urban development. Urbanization has also increased organic waste problems and other wastes in and around the area. Municipal solid waste management continues to be a major challenge for local governments in both urban and rural areas across the area. A number of solutions have been developed, pilot-tested and even implemented; they operate mostly in storage tower, which decrease their effectiveness. This is because effective and sustainable waste management requires seamless transition and hand-offs across the various stages from generation to collection, treatment, and reuse.

People mostly do not separate wastes at home since there is no awareness, knowledge, facilities, nor incentives to do so. In addition, the way of life, especially with regard to food, tends to produce large amounts of waste, such as numerous plastic bags for carrying cooked and fresh food from markets. Separation of kitchen wastes is not easy. The public's knowledge on hazardous waste is minimal. Communal bins are small and insufficient and frequently overflowed with garbage. The Corporation was soon faceted with the problem of waste management. The Corporation (Figure 3) tries to sold this by using the resources at the Brahmapuram Waste Management plant located in the outskirts of the city but the sheer volume of waste being generated every day in the city makes the management of it a herculean task. It is the need of the hour to have decentralized systems in Kochi and nearby municipalities to manage both wet and dry waste separately. A proper decentralized system for waste management is needed for reasons ranging from better health and sanitation, environment conservation, climate change mitigation, resource recovery and improved standards of living.

# II. OBJECTIVES:

- Create awareness among the local community for a decentralized system of waste Management
- Start and operate a community based composting unit for domestic food waste
- Start and operate a door to door collection system for dry waste
- Arrange a space for storage and sorting or dry waste with forward linkage for Quantification and Documentation of all wastes thus collected and processed recycling
- Make the compost ready and available for the local community
- Train kudumbasree workers to make upcycle products from plastic wastes and marketing them

## III. METHODOLOGY

The present study follows systemic methodologies in which different concern have been exposed during the progression. Basically this means that there was no clear picture of the systems in the beginning of the study, but that the concept has been developed during the innovation process through constant feedback and discussion with residents and local representatives. The study is planned to function as a part of the development process; the typical framework and application is replaced with a more self-motivated approach. Data collection in the study is based on personal inquiry and literature review concerning solid waste management systems. Following methodology was followed:

• <u>Awareness</u>: Through demonstration classes using models, visual aids, street-plays, door to door communication and enrolment (Figure 4 & 5).

**Collection:** Door to door collection using manually operated push carts. To be collected on a daily basis. Two workers to do so, using push carts. About sixty houses were covered by each worker and a total of houses 120 houses were covered. Food wastes were transferred from household buckets into small covered drums in cart. Food waste NOT to be given in plastic covers. Maximum "dryness" to be recommended. (Figure:6)

**Sorting**: Dry recyclables sorted and graded manually. Dry Waste to be collected ONCE a week. Collected in Sacks. Brought to Scrap Dealer Agent. Manually Sorted Recyclables with Sales Value to be given to Scrap Agent. Non-recyclables to be removed once in a month and sent for Upcycling

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• <u>Composting</u>: Thermophilic composting and windrow methods, followed by selective vermicomposting were done. (Figure 7)

*Composting*: Kitchen waste to be mixed with suitable bulking agent Eg: Dry leaves, saw dust, wood chips. Ensure combination of greens and browns (Nitrogen and Carbon balance). (Figure 8 & 9)

*Thermophilic Method*: to be used initially – Packed in tall drums of 1 meter height, to ensure temperature build up 60-70 degrees, speeds up composting, temperature inhibits undesirable pests. Kept in this state for 4 days, drainage of slurry endured

*Windrow Composting*: after 4 days, drums emptied, matter mixed with dry leaves, cured for 14 days, turned and mixed every 2nd day, aerobic exposure ensured

Neutralized with lime and cowdung

Cured for 30-40 days, pH ensured and subject to vermicomposting in earthen pots.

▶ <u>Partnership:</u> With plan@earth, a NGO with proven track record. Plan@Earth is a Voluntary Organisation based in Kerala, India. They are non-profitable organisation registered as a Charitable Trust. "Plan @ Earth" has been registered under the Travancore – Cochin Literary Scientific and Charitable Societies Registration Act, XII of 1955 as Register No. ER-313/2009 on 13.05.2009. With the intention of spreading awareness and creating concern about the need to preserve and protect our environment we started operations in the year 2009.

## Process

1. Project to be done in 120 houses

2. Door to door collection of food waste carried out daily by one push carter (60 houses) x = 120 houses

3. Food waste to be stored in open buckets by households and emptied into small drums in push carts, drums to be covered during transport

4. Food waste brought back mixed with bulking agents and subjected to thermophilic composting

- 5. After specified days arranged in windrow tanks and regular turning to be executed
- 6. After specified days mixed with cowdung and packed for further curing

7. After 45 days subject to vermicomposting in pots

- 8. Dry waste to be collected every week in sacks.
- 9. Dry waste that is clean and "dry" only to be collected, will include paper, plastic, glass and metal

10. Households to hand over dry waste openly and NOT in plastic kits to avoid unwanted material eg napkins and diapers

11. Dry waste to be brought back to sorting hub and sorted into grades

- 12. Recyclables to sold and directed to respective recyclers
- 13. Non-recyclable inerts to be removed by agency once a month

# IV. RESULTS AND DISCUSSIONS

Solid waste generation has been recorded to increase day by day. This has been found due to over population growth rate, industrialization, urbanization and economic growth. Consumerism speed has been found very high since last decade due to higher economic growth, which has ultimately resulted in increased solid waste generation.

The project's ultimate goal was to strengthen capacity-building and introduce the concepts of participation, community-based development, effective management and good governance into the local government. The word 'community' here refers to a sub-unit within the municipality, where people have organized themselves and have been officially recognized as an entity by the municipality. Some of them may even believe that 'their littering practice is the right thing, in that it offers employment for someone else' (Mongkolnchaiarunya, 1999), and this leads to lack of respect for informal rules of socially responsible behavior.

The study recommends an integrated waste management structure involving government waste contractors, the informal sector and the communities. They reduce the amount of waste reaching the landfills. Challenges including the informal nature of the sector across the value chain, inadequate interaction and engagement between various waste management service providers, and lack of data to support the required policy decisions. Another critical and common challenge encountered by most enterprises is the stiff competition given by the informal and illegal waste operators or waste *mafias*. Most important challenge faced by waste management enterprises is that 60 to 70 percent of

the waste collected is organic, and the compost generated out of it attracts quite low prices, thereby impacting the financial viability of such enterprises.

Even though one can't expect much commercial earnings from compost units, the biodegradable organic waste can be converted it in to Vermicompost. When earth worm feed on organic waste, it undergoes physical and chemical break down during the processes of ingestion and digestion. About 5-10% of ingested material is absorbed into the tissue for their growth and metabolic activity and rest is excreted as cast. The cast is mixed

with mucus secretion of gut wall and of the microbes. These had the structural stability of cast which is used as Vermicompost. The decomposition process continues even after the release of the cast by the establishment of microorganisms. The nutrient level depends upon nature of organic waste used as food of earthworm.

According to Ismail, (2005) earthworms contribute nutrients in the form of nitrogenous wastes. Their casts have higher base-exchangeable bases, phosphorus, exchangeable potassium and manganese and total exchangeable calcium. Earthworms favored nitrification since they increase bacterial population and soil aeration. The most important effect of earthworms may be the stimulation of microbial activity in casts that enhances the transformation of soluble Nitrogen into microbial protein thereby preventing their loss through leaching to the lower horizons of the soil. C: N ratios of casts are lower than that of the Surrounding soil.

Documentation was done regarding the number of households covered, the quantity of waste collected, the grades the waste was organised into and the recycling done. It also covered the charges incurred as part of the periodical expert visits done by the officers of PlanatEarth to the target area.

Month	Number of Participating Houses	Weight of Dry Waste collected
December	12	26 kg
January	76	190 kg
February	217	542 kg
March	423	1184 kg
April	438	1201 kg
May	447	1193 kg
June	445	1211 kg

Table: Shows the monthly collection of wastes in kg

Total 5547 kg of plastic waste has been removed. Some non –recyclables have to be despatched to cement manufacturers for use as RDF. This process incurs charges.

## STRATEGIES TO REDUCE SOLID WASTE

- Create awareness among the resident population.
- Enable reuse and recycling centers to reuse waste materials disposed of at these sites through the resale of reusable items.
- Charge people on the basis of volume of waste and frequency of collection.
- Offer incentives to households to produce less waste.
- Promote home and community composting in the city.
- Share new ideas and techniques of effective solid waste reduction and disposal methods.
- Home and community composting may be promoted through the provision of biogas plants at low cost or with subsidies.
- Communicate through residential associations the various effects of solid waste management problems.

## CHANGE MIND SET OF THE PEOPLE REGARDING WASTE DISPOSAL AND OTHER ISSUES

# V. CONCLUSION

As a concluding remark, the author would like to point out only one thing. Cochin has everything to deal with the mounting menace of waste- man, machinery, laws everything; however, the problem comes in the implementation part. All schemes start of greatly, but fail to achieve to goal. Almost all the projects seem to be losing their way in the middle of the way. Hence, it would be advisable that, before reaching to a conclusion about the Solid Waste Management system in Cochin City, one waits and watch whether all these schemes materialize or they remain in papers alone.

The project was well received by the target community. The members of this community have understood the need to manage plastic waste properly. Through the methods of reduce, reuse and recycle as well as the techniques for home composting, the community had gained the capacity to manage their waste properly. However towards the end of the project term when the funds were utilized the project shifted to a system where the households were informed to pay for the recycling services extended. This mandated a user fee of Rs 100 per month as per the directive of the Kerala State Suchitwa Mission as well as the Haritha Kerala Mission.

Many of the households have pulled out of the project and the few households that remain in the project get their waste removed once a month upon payment of Rs 100 user fee.

The impact of the project is that the community learnt that waste can be managed properly and the strategies of reduce, reuse, refuse, recycle and composting were taught to the residents of ward VII. The students

and the teachers of the Department of Zoology got a good exposure to working with a community and got the chance to take workshops, awareness classes and conduct surveys.

Community interventions on adopting the source segregation, applied polluter's pay principle (PPP), re-processing and recycling has helped significantly reduce the waste generation in the source and also help to minimize it going to the landfill. The ultimate products that are produced from the management is being recycled, reused and thus recovered withdrawing the optimum financials that covers the regular cash flow deficits of this small and medium scale enterprise (SMEs). This has entirely proved to manage solid waste efficiently.

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Figure 1 & 2- Map that shows the location of ward 7 of Kochi cooperation (marked A) in Kerala. (Google Maps 2018.)

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Figure 3. General view on the main street of ward 7.



Figure 4: Awareness and training classes for residents of Ward 7, Kochi Cooperation.



Figure 5: Students Survey, awareness and registration done in different residents association of Ward 7, Cochin Cooperation.



Figure: 6 Glimpses of Awareness class and collection process -BIOMAG 2018



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Figure 7: Initiatives taken by students for waste management, collection of vegetable waste.



Figure 8: Preparation of Vermipot by students.



Figure 9: Harvesting of Vermicompost.