CONVERTING WASTE PLASTIC INTO FUEL AND ALLIED PRODUCTS

GUIDES

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EXECUTIVE SUMMARY

Plastic is a wonderful invention of the previous century. We can't imagine a day in our lives without the use of plastic. Most of us start our day by brushing our teeth with a plastic brush and wearing chappals made of plastic. Many of the clothes we wear contain plastic like polyester, nylon, acrylic, and polyamide. We use plastic plates and glasses and take medicine packed in plastic films and bottles. We get milk in plastic sachets. The automobiles we ride, TV we watch, pens we write with and computers and other electronic devices we use all have plastic parts. When we come back home and take a bath, we come across shampoo bottles and soap trays made of plastic. In all the places we go to, like our workplace, office, school or college, hospital, hotel, etc; we see the use of plastic in some way or the other.

But plastic is a major environmental problem which needs to be addressed. Plastic can be avoided by using bamboo tooth brushes, shampoo bars, cloth carry bags, etc, but this isn't done as people find using plastic more convenient. We can recycle or repurpose plastic waste. But after plastic has been recycled a few times, it usually isn't suitable for a further recycling. Also, most people throw out old plastic products and buy a new one for that specific purpose. This leads to a lot of plastic being littered in the environment which even rag pickers rarely pick up because the value for plastic is negligible. We found that by adding value to the waste plastic, people won't throw it away and will start collecting it so they can earn some money out of it.

SoanS Corporation developed a small, affordable machine which converts plastic waste into fuel or a Viscosity Diluter, for micro entrepreneurs or factories which have a captive requirement. The Viscosity Diluter produced from plastic waste could be used in the roofing tile industry and the brick making industry. The fuel from the plastic waste conversion could also be used in oil burners where they use LDO, IP sets where they use diesel, and in Generators. The capacity of this machine is around 50,000 ltr per year on a single shift basis. The idea is to have a small plant in many locations, owned by micro entrepreneurs so the plastic waste generated in that region is processed right there. This will help micro entrepreneurs, village Panchayats, municipalities and dumping yards to source available plastic waste in that region. Waste collection centres could produce this fuel or Viscosity Diluter, and sell it for a better value than what they would have got before for selling waste

plastic. During the survey, we found that the value for plastic waste like carry bags, chocolate wrappers, plastic films, blister packs (pill packaging), medicine bottles, etc, was close to nil which meant there were no takers. By creating a demand for these through the machine, we would also be keeping the environment clean.

A study on the Viscosity Diluter was carried out in the roofing tile industry 'Prabhakar Tile Works' which started in 1931. Prabhakar Tile Works Group has two tile factories with manufacturing capacity of 140 tiles per minute. They use kidden oil with kerosene which is used as a Viscosity Diluter to lubricate the tile dies. The annual requirement of each plant is about 30,000 ltr of kerosene. As kerosene is in short supply, there's a great demand for Viscosity Diluters. After calculating the cost of production of the Viscosity Diluter, it was found that if a factory makes its own Viscosity Diluter from plastic waste, it can save more than 50% of the cost of kerosene in present rates.

To find the availability of waste plastic three different methods were used:

1. Consulting several sources online we found the total plastic waste generation of India to be in the range of 15,000 to 25,000 tonnes which is why we took an average of 20,000 tonnes to be the total plastic waste generation in India per day. Using this, we calculated India's per capita plastic waste generation to be 5.38 kgs per year.

2. A convenience sampling was carried out in 10 houses of family and friends to find the average plastic waste generation per household. Using this data, we have found the average plastic waste generated per person to be 3.8 kgs in a year.

3. A physical survey was done by 13 gram Panchayats in which we found the per capita plastic waste generation to be 0.9kgs. As they are only a few small towns with a population between 3,000 to 15,000 and we could not track the plastic littered on the roadsides and environment, we can't take 0.9kgs into account.

INTRODUCTION

India has a population crossing 1.35 billion and generates 1,50,000 tones of municipal solid waste per day, out of which 25,940 tones is plastic waste. Around 70% of total plastic consumption in India is discarded as waste, and 40% of this remains uncollected. Nearly 50% of plastic used are single use items, and annual plastic consumption is expected to rise to 20 million tonnes by 2020.

Plastic has become a major environmental problem as it isn't biodegradable. Nature works in a cyclic manner. Anything produced in nature becomes a matter of consumption for another organism. By producing plastic and by not processing the waste, we aren't closing the loop.

Used plastic bags, packaging wrappers, old plastic pipes of broken down buildings or irrigation waste, plastic bottles, pens and milk packets", are used only once, and though very useful, usually end up in landfills or the sea. Many animals and sea creatures eat this plastic which is very hazardous to their health. To avoid this many states have banned certain plastic industries resulting in thousands of people losing their jobs.

Why do people throw plastic away, and why don't people pick up plastic littered on the road whereas we never see a piece of metal lying outside for very long? The reason is that metal scraps have a much higher value than plastic.

In this project we've tried to treat the waste plastic, and produce fuel and Viscosity Diluters, with a minimum investment, while giving opportunity to small entrepreneurs so that plastic will find a greater value which will result in less people throwing it out, while also financially helping the local community.

ABOUT PLASTIC

What is Plastic?

Plastic is a material consisting of any wide range of synthetic or semi - synthetic organic compounds that are malleable, and so can be molded into solid objects.

Plastics are made out of a wide variety of organic and inorganic compounds. They're mostly synthetic and often made of petrochemicals, although many plastics are partially natural. Bio plastics are made from renewable biomass resources including vegetable fats and oils, cornstarch and even bacteria.

Image Source: indiatoday.in

Types of Plastics

Repurposing is the process by which an object with one use value is transformed or redeployed as an object with an alternative use value. All plastic can be repurposed.

Recycling is the process of breaking down objects into materials to make new things.

1. **Polyethylene Terephthalate (PET/PETE/Polyester)**

   PET is known as wrinkle free fibre. It's mostly used for food and drink packaging purpose due to its strong ability to prevent oxygen from getting in and spoiling the product from the inside, and also to stop carbon dioxide in carbonated drinks from getting out.

   It can be recycled.

   It contains antimony trioxide which is considered as a carcinogen.

   It is used to make soda bottles, water bottles, salad dressing bottles, medicine jars, peanut butter jars, combs, bean bags, tote bags, ropes, carpets, fibreglass material in winter clothing, etc.

2. High Density Polyethylene (HDPE)

   HDPE has a long, virtually unbranched polymer chains which make them really dense, and thus stronger and thicker than PET.

   It's used to make that clear, hard to open plastic packaging you see on some products.

   It is recyclable.

   It is used to make milk bottles, shampoo bottles, detergent bottles, grocery bags, milk, juice containers, medicine bottles, and packaging for laundry detergents, bleaching agents and soaps.

3. **Polyvinyl Chloride (PVC)**

   PVC is considered as the most hazardous plastic.

   It isn't food safe and usually isn't recyclable.

   Because PVC is relatively impervious to sunlight and weather, it is used to make window frames, garden hoses, arbores, raised beds and trellises.

   It's also used to make sheathing for computer cables, water pipes, toys, blister wrap, cling film, loose-leaf binders, blood bags, shoes and sewage pipes.

4. **Low Density Polyethylene (LDPE)**

   Although studies have shown that LDPE could cause unhealthy hormonal effects

   In humans, it is considered as a safer plastic option for food and drink.

   It is difficult to recycle.

It is used to make grocery bags, cling wraps, sandwich bags, squeeze bottles, coating for milk cartons, hot and cold beverage cups, food storage containers, and wire and cable covering.

5. Polypropylene (PP)

Polypropylene is tough, lightweight, and has excellent heat resistant qualities. It serves as a barrier against moisture, grease and chemicals. Its strength is somewhere between LDPE and HDPE. It is considered a safer option for food and drink use.

It isn't recyclable.

It is used to make hot food containers, Tupperware, medicine bottles, diapers, straws, rope, potato chips packets, car parts and disposable cups and plates.

6. Polystyrene (PS)

PS is the Styrofoam we all commonly use for food containers, egg cartons, disposable cups and bowls, packaging and also helmets.

It's an inexpensive, lightweight and easily formed plastic with a wide variety of uses.

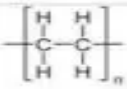
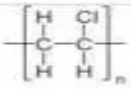
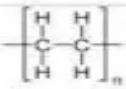
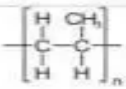
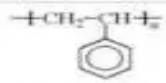
When exposed to hot and oily food or heated, it leaches styrene which is considered a human carcinogen.

It can't be recycled.

7. Others

The remaining plastics include polycarbonate, polylactide, acrylonitrile butadiene, acrylic, styrene, fibreglass and nylon.

They are used to make plastic CDs and DVDs, baby bottles, large water bottles with multiple gallon capacity, eyeglasses, medical storage containers and exterior light fixtures.

Resin Code	Polymer Resin	Structure	General Applications
1 PET	Polyethylene Terephthalate		• Plastic drinking bottles • Food jars
2 HDPE	High Density Polyethylene		• Shampoo, dish, laundry and house cleaning bottles • Shipping containers
3 PVC	Polyvinyl Chloride		• Packaging materials • Pipes, fencing • Blood bags, medical tubing
4 LDPE	Low Density Polyethylene		• Bags for dry cleaning & newspapers • Shrink wrap, film
5 PP	Polypropylene		• Medicine bottles • Bottle caps • Automotive parts • Carpeting
6 PS	Polystyrene		• Disposable cups, utensils, food containers • Foam packaging
7 OTHER	Other	Resin is other or a mixture of mentioned resins	• 3 and 5 gallon reusable water bottles • Packaging

Methods of Disposal of Plastic

1. Land filling

This method is highly wasteful as it requires a large amount of space and the chemical constituents and energy contained in the plastic is wasted. If the landfills are poorly managed, plastic waste can easily be blown into waterways or carried out to sea by flood water. When the plastic decomposes in the landfill, or comes in contact with hazardous waste, it leaks pollutants into the soil and surrounding environment. When it rains, these toxins seep into the ground and pollute the groundwater.

2. Incineration

Plastics are derived from petroleum or natural gas. Giving them a stored energy value higher than any other material commonly found in the waste stream. Incineration returns some of the energy from plastic production, however it tends to have negative environment and health effects, as hazardous substances may be released into the atmosphere in the process.

3. Recycling

Recycling plastic conserves natural resources and energy that would be required to produce plastic from the scratch. There are short term advantages to the environment from recycling plastic but the long term results aren't good. When

plastic is melted in the process of recycling, Volatile Organic Compounds (VOCs) are released into the atmosphere, harming the nearby plant and animal life. As heat is required to melt plastics, the process generates carbon emissions which contribute to global warming. After plastic has been recycled, it's is very rarely suitable for a second round of recycling. This means that the material will eventually end up in the waste, despite its secondary, prolonged use.

4. Harmful effects of Plastic

Plastic pollution is defined as the accumulation of plastic objects in the earth's environment that adversely affects wildlife, wildlife habitats and humans. Overuse of plastic is one of the main causes of plastic pollution. Plastic is cheap and widely available, but people frequently dispose of plastic items. They don't decompose and the release an incredible amount of toxins into the air if they're burned.

Image source: https://pixabay.com/photos/garbage-stinky-dump-site-woods-2832778/

Image source: https://pixabay.com/photos/pollution-drina-plastic-waste-203737/

Effects on Water

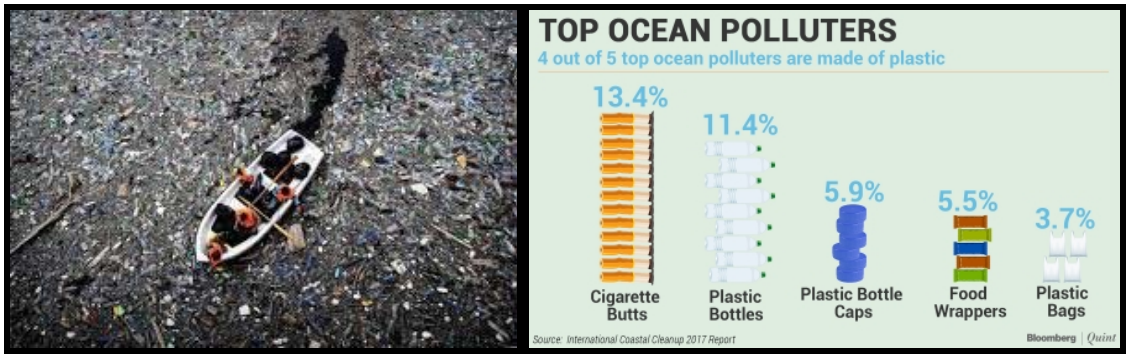
During rainy season, the plastic rubbish that has fallen on the road gets washed away into the nearby water reservoirs, canals and drains, leading to their choking up and overflowing.

When dumped in landfills, plastic materials interact with water and form hazardous chemicals. If these compounds seep down towards groundwater aquifers, they degrade the water quality, leading to groundwater pollution.

Plastic pollution in marine water bodies leads to innumerable deaths of aquatic animals, and this also affects the aquatic plants to a considerable degree. The environmental balance of the waterways is being thrown off by the rate of plastic bags finding their way into the mouths and intestinal tracts of sea mammals. As one species begins to die off at an abnormal rate, every other organism in the waterway is impacted.

Blockage due to plastic accumulation form breeding grounds for mosquitoes and other harmful vector insects which might cause numerous diseases in humans.

AAP Image/Department of the Environment and Heritage/Melbourne Zoo



The Great Pacific Garbage Patch

Source: The Litter Mug Challenge.

http://www.litter-mugs.org/images/challenge/plastic-ocean-400w.jpg

Effects on Land

Wind carries and deposits plastic from one place to another, increasing the land litter. It also gets stuck on fences, trees, towers and buildings, and any animal that comes in its vicinity might even get tangled in it and suffocate to death. It has been estimated that.

One plastic bag has the potential to kill one animal per every 3 months due to unintentional ingestion or inhalation. If you consider the number of plastic bags ranges from 1.5 million to 3 million depending on the location, this equals a lot of ecosystem sustaining life lost. Almost 200 different species of animals are known to

ingest plastic debris. The larger number of potentially affected species and ecological functions, the more likely it is that toxic effects occur.

The indefinite period of time that it takes for the average plastic bag to breakdown can literally be thousands of years. Generally speaking, when plastic particles break down, they gain new physical and chemical properties, increasing the risk that they will have a toxic effect on organisms and inhibit soil nutrients.

Effects on Air

When plastic is burned, it releases a large amount of toxins which include nitrogen oxide, sulphur dioxide, VOCs and Polycyclic Organic Matter. It also releases heavy metals and toxic chemicals such as dioxin. This depends on the type of plastic burnt. Over time, toxins accumulate in food crops, animals and fish people eat while endangering the wildlife and also contaminating the atmosphere. If the toxins are inhaled for a long period of time, it can lead to respiratory problems.

Effects on People

Many different chemicals are used while making plastic to improve its properties. Several of these substances can migrate under different circumstances as they aren’t bound by the chemical chain of the plastic. Opening a new plastic product that has a strong odour, applying body lotion, drinking or eating something hot from a Styrofoam container, breathing in an area where plastic is being burnt,

reusing a disposable plastic water bottle, eating food that has been microwaved or frozen in a plastic container, etc, allows the toxic chemicals from the plastic to migrate into out body. They can cause many health problems like vision failure, cancer, respiratory problems, liver dysfunction, skin diseases, lung problems, dizziness, headaches, etc. The three most commonly cited plastic additives are Bisphenol A (BPA), Plasticisers or Phthalates and Flame retardants.

METHODOLOGY

Availability of Plastic Waste

The following are the methods we used to find the availability of plastic waste in India:

Case 1

According to several sources on the internet, the plastic waste generation in India is said to be 15000 tonnes or 25000 tonnes per day. Out of the two, we have considered an average of 20000 tonnes per day to be the total plastic waste generation in India. (See Appendix A)

Per capita plastic consumption of India per year = 11kgs

Plastic waste generation of India per year = 73,00,000 kgs

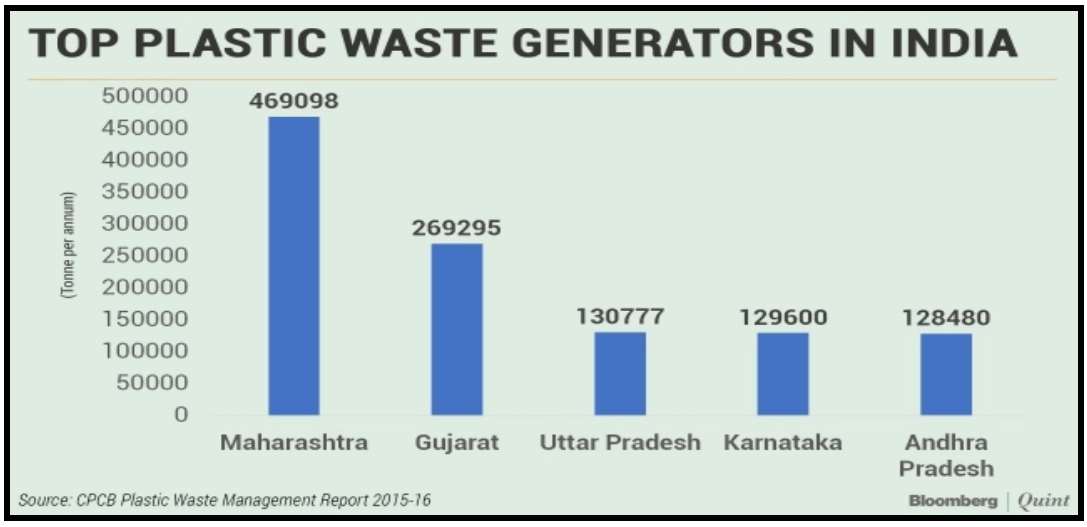
The projected population of India as on 2018 is 1,35,81,37,719 which will give a per capita plastic waste generation of 5.38 kgs per year.

The quantity of plastic waste generated in Karnataka per day = 900.6 tonnes

The quantity of plastic waste generated in South Canara per day = 33939 kgs

The quantity of plastic waste generated in North Canara per day = 18994 kgs

The quantity of plastic waste generated in Udupi district per day = 22216 kgs



Case 2

We have carried out a convenience sampling were 10 households of friends and family. They were asked to keep watch over the waste plastic generated in their households for 30 days. In most of the households, the amount of plastic waste generated was the same. But in some cases we noticed the garbage generated was more than the plastic brought in due to the items like washing machine detergent containers, plastic combs, plastic mugs, shampoo bottles and plastic containers which were bought in the past being discarded

Table: Plastic Waste generated in a Household in a Month (in kgs)

Household	Plastic Waste Generated per Month in kgs
A	0.73 kgs
B	3.65 kgs
C	3.65 kgs
D	8.5 kgs
E	9.12 kgs
F	2.12 kgs
G	2.64 kgs
H	2.55 kgs
I	2.07 kgs
J	3.04 kgs

Using this data, we have found the average plastic waste generated per person to be 3.8 kgs in a year.

Case 3

We considered doing a survey using college students. For this purpose we made aquestionnaire which has be written below (See Appendix B). We did the survey ourselves on one gram Panchayat and decided not to go through with our plan as we found that the gram Panchayats have well tabulated data. The municipalities are in the process of tabulating their data because they don’t have enough manpower.

Case 4

We went directly to the gram Panchayats to source the data. There we met Mr. Udhay Kumar Shetty and Ms. Vijaylaxmi who work with the Vandse Gram Panchayat who helped us with the data collection. Mr. Udhay Kumar Shetty put us onto Mr. Murthi T.- Project Coordinator and Consultant, Swatch Udupi Mission. He who helped us with gathering the data of the other Gram Panchayats. We have attached our findings in the following pages.

The physical survey done by 13 gram Panchayats amounts to per capita plastic waste generation of 0.9 kgs per year. These are very small villages with a population of 3000 to 15,000. We still see waste plastic thrown around outside. Here, bigger towns in our district aren't taken into account as the data wasn't accessible. Therefore the 0.9 kgs in the villages justifies the survey that 40% of the Garbage is produced in the few major cities in the country

Average Monthly Plastic Collection in Gram Panchayats in kgs						
Gram Panchayat	**A**	**B**	**C**	**D**	**E**	**F**
Vandse	290	288	51	103	732	2.69
Varamballi	508	413	39	99	1059	1.866353
Hebri	241	207	32	79	559	1.116883
Karkunje	163	223	66	54	506	1.392341
Gangolli	152	139	48	15	354	0.326418
Siddapur	136	197	51	45	429	0.695582
Amasebail	49	69	15	0	133	0.526038
Hangalur	18	40	11	43	112	0.334578
Trasi Hoasadu	174	148	158	6	486	0.911108
Mundkoor	332	170	12	3	517	0.873803
Kokkarne	56	49	25	175	305	0.453813
Marvanthe	96	73	18	41	228	0.519658
Hardali-Mandali	106	63	5	13	187	0.680412
Total	**2321**	**2079**	**531**	**676**	**5607**	

Total no of people in 13 gram Panchayats = 74771

Per capita plastic waste generated in 13 gram Panchayats = 0.90 kgs

A – Plastic items

B – Plastic covers

C – MLP's

D – Plastic Footwear

E – Total

F – Per capita waste generation as per survey (physical)

We didn't take sanitary items like sanitary napkins, diapers, etc, and Thermocol because sanitary items contain materials other than plastic and therefore don't give a high yield and Thermocol cannot be converted into fuel using the above processes.

Collection and Segregation Centre at Vandse

Mr. Udhay Kumar Shetty and Ms. Vijaylaxmi.

Women segregating the waste.

Cleaned and Segregated Plastic.

The data collected from 13 gram Panchayats is in Appendix B.

SOLUTIONS

What can be done with Plastic waste?

Plastic waste can be used to make pavement blocks and housing blocks. It can also be used in making roads. Some companies are even making shoes out of waste plastic. Adidas has produced 5 million pairs of recycled plastic waste shoes in 2018. In this project, we have converted plastic waste into Viscosity Diluters and fuel which can be used to make various value added products.

Process of Conversion

The following different Processes are used for Processing and Reclamation of Petroleum Oil. Few of them are used to improve the quality of the products or to manufacture value added products.

1. Fractional distillation
2. Dehydration Process
3. Esterification Process
4. Sulphonation Process
5. Pyrolysis Process.

1. **Fractional Distillation**: This consists of heating the crude oil, lighter or heavier crude under vacuum condition and separating the cuts fragments as per every product's IBP (Initial Boiling Point) and FBP (Final Boiling Point) that is at what temperature it starts evaporating and at what highest temperature it evaporates completely... Only physical properties of each product like Density, Flash Point, Colour, IBP and FBP can be controlled and adjusted.

   This process can be used to separate Naphtha, Kerosene (SKO), Diesel (HSD), Light Diesel Oil (LDO), and Furnace Oil (FO). Asphaltenes (Bitumen). This process can also be used to further process Kerosene (SKO) Diesel (HSD) to manufacturing value added products like insect repellent. Ink Oil (used for manufacturing inks, Printing inks), Aluminium Rolling Oil (ARO), used for quenching Aluminium Foils. This is absolutely pollution free process.

2. **Dehydration Process:** Same process that of Distillation except no fractionation. Only heating it up to 110 degreeCelsius under vacuum condition and removing water to make Oil bone dry and use it as fuel. This process is used to take care of reclamation of Oil during Oil slicks in Ocean if any ship (vassal) leaks profusely

and Oil is swept on to the shore. This contains water to the tune of 27 degrees to 30 degrees and is rendered useless. This has water pollution. The reclaimed water has to be treated in ETP (Effluent Treatment Plant) and used for watering plantations and in factory areas.

3. **Esterification Process:** This process is the chemical Process in which solvent (METHANOL) is reacted in presence of Potassium or Sodium Hydroxide with vegetable Oils in which the FFA (**F**ree **F**atty **A**cids) is reacted, converted in to Glycerol (Crude Blycerele) and the vegetable oil is converted into Biodiesel. Methanol Solvent works as a catalyst and is reclaimed. The property is similar to customary Fossil Fuel Diesel. Almost Zero Pollution. Only water used for washing of KOH or NaOH which is treated in ETP and reused.

4. **Sulphonation Process:** This is a very corrosive process in which products produced from Fractional Distillation is treated with **Sulphuric Acid** (H2SO4) or Stronger version of Sulphuric Acid called **OLEUM**. This reacts with Sulphur, Benzene called as Aromatics and makes the Oil completely safe for the human use. Sludge, Black mass is formed which has to be drained out and incinerated.

   The oil which is treated with acid is acidic and has to be neutralised with Sodium Hydroxide, cleaned with water, dehydrated to make it bone dry. Value added products can be made.

5. **Pyrolysis Process**: This is a simple process where in Plastic waste articles can be broken up into small pieces may be the sizes of flakes. This plastic is then heated slowly up to 310 degrees Celsius, The plastic disintegrate. The hydrogen/Carbon/Oxygen bond is broken; the oil content in it evaporates. These Evaporated vapours are condensed in cooling condenser and oil is reclaimed.

   The very Volatile Oil which can be condensed only by using refrigeration goes uncondensed in Vapour form and is redirected to the burner used for the heating Process. No Emissions are observed.

   The process called as Pyrolysis Process is safe with no pollution. This process only produces 10% to 20% gas. Only a clean fuel is used in burner, initially fired by LPG, and then taken over by the gas produced in the process. The Ashes hardly 5% of the total feed stock and is neutral in nature.

Cost of conversion

Plastic is used for many different purposes. Plastic in its pure form isn't suitable for most its common daily uses. Here, we are extracting the fuel content from the plastic. Fillers such as Aluminium Tri Hydrate(ATH) is usually used to give strength and different characteristics to the plastic. It also reduces the cost of the final product. However, as the quantity of the filler increases, the yield of the oil reduces. In the machine used for the case study, when plastic bags which have very little filler are used, it yields fuel production between 40% to 50%. We have found that the carry bag in the picture below gives the best yield. The economics of the machine working is based on the working of the below plastic.

This machine consists of a shredder for plastic waste, a reactor, condenser, cooling tower, circulation pipe, blower, gas collector, temperature sensor and catalyst chamber. It works on an anaerobic process using pyrolysis principle

The total electric connection required = 3/4rth hp
Batch capacity of the plant = 100kg
Cycle time = 3 hrs

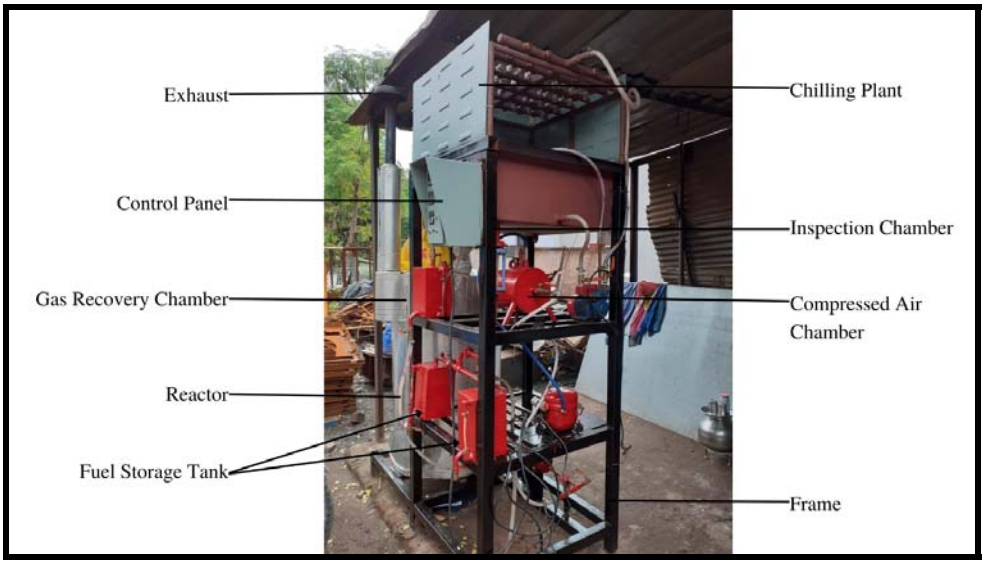
Here we heat the plastic using an anaerobic process were plastic is heated, not burnt, hence avoiding all harmful effects of burning plastic. For the initial heating,

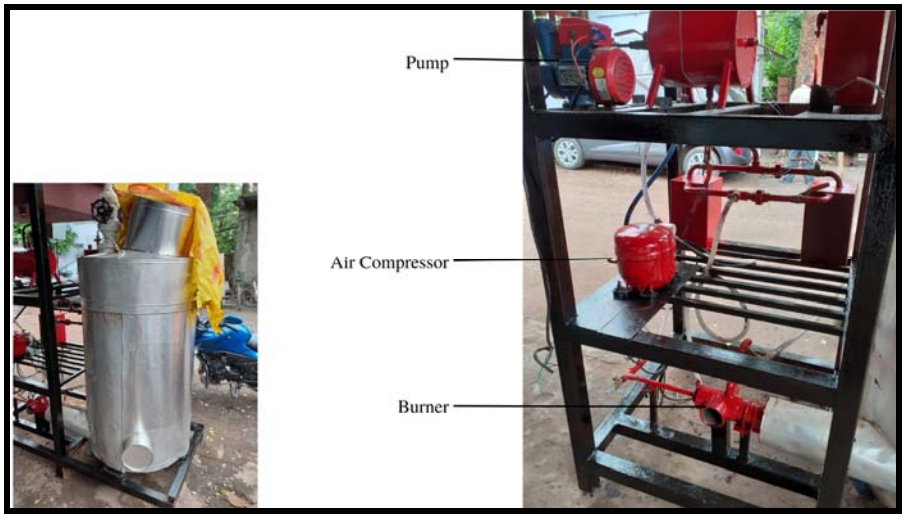
LPG gas is used. As the heating continues, the molecules are broken forming gas. This gas, when condensed gives liquid fuel, and the unburnt gas which is around 10% to 20% is fed back into the burner. Once the flow of this gas starts, the LPG gas supply is shut off manually. Hence, the requirement of energy for the process is the bi-product of the process itself, and a very minimal startup LPG gas is used.

Cost of the machine	= Rs.15, 00,000 + 5% GST	
Cost of installation and commissioning	= Rs. 75,000 + 18% GST	
The raw material required for 3 cycles	= 100kg per batch x 3 batches	= 300kg
Total fuel production per day	= 60l per batch x 3 batches	= 180l
On 300 working days, total fuel production (in Liters) = 180l x 300		= 50,000l
Total raw material required (in Kgs)		= 90,000
At Rs.5 per kg, total cost of raw material		= Rs.4,50,000/-
Variable Cost		
One person, at Rs.12,000 per month,		= Rs.1,44,000
Financial costs around 10%		= Rs.1,70,000/-
Cost per litre	= Rs.3,14,000/50,000l	= Rs.6.28
Cost of electricity per batch	= 2 units	= Rs.14/-
Cost of electricity per litre	= Rs.14 / 60l	= Rs. 0.3
Cost of raw materials per litre	= 4,50,000 / 50,000	= Rs.9
Total cost of producing 1 ltr of fuel = Variable cost + Electric cost + Cost of raw material	= 6.28 + 3 + 9	= Rs.15.58
Miscellaneous expenses per litre (Wastage, evaporation, etc)		= Rs. 2
Total expenses	= Rs. 17.58	= Rs.18
Selling price		= Rs.40
Profit per litre		= Rs.22
Profit per year	= Rs.50,000 * 22	= Rs.11,00,000
Less overheads		= Rs.2,00,000
Net profit per year	= Rs.11,00,000-Rs.2,00,000	= Rs.9,00,000

Utility of the converted Product

Plastic converted into fuel has been used as an alternative to diesel in generators, irrigation pumps, and oil furnaces for heating water or for heating in industries. Also, it can be converted into Viscosity Diluters which are used in roofing tiles and brick industry or any industry that needs diluted lubricants. Further processing of these Viscosity Diluters can go into paint industry. At present, there are plastic processing plants which are of very high capacity, and can't be afforded by small entrepreneurs. Further processing of Kerosene (SKO) and Diesel (HSD) can manufacture value added products like insect repellent, Ink Oil (used for manufacturing inks, Printing inks), Aluminium Rolling Oil (ARO), used for quenching Aluminium Foils.





Improvement in Colour

CONCLUSION

The majority of PET bottles and virgin plastic get recycled for various uses. However carry bags, pipes, packaging material, plastic film, toys, pens and other products can’t be recycled after the second or third recycling process, and end up creating environmental problems.

There are many experiments going on to convert waste plastic into useful products such as pavement blocks, housing blocks, fuel, Viscosity Diluters, etc. Conversion of plastic into pavement blocks and housing blocks require high investment, and the demand hasn’t picked up yet. At present, there are plastic processing plants which are of very high capacity, and can’t be afforded by small entrepreneurs.

However plastic converted into fuel has been used as an alternative to diesel in generators, irrigation pumps, and oil furnaces for heating water or for heating in industries. The process of pyrolysing plastic requires some heating. For this, we need to burn gas or oil, leading to the production of carbon dioxide which goes back to nature. It can be said that this increases the carbon footprint, but this is minimal in comparison to the damage the plastic would've caused otherwise.

The aim is to create many small entrepreneurs by providing smaller capacity plastic processing machines at a lower cost to be used in many places. This will create a rise in the demand for waste plastic as it is used to produce fuel which is in demand, at a very low rate. The industries or entrepreneurs could have their own captive plant to make fuel for their own requirement. This will both help the community, and keep the environment clean.

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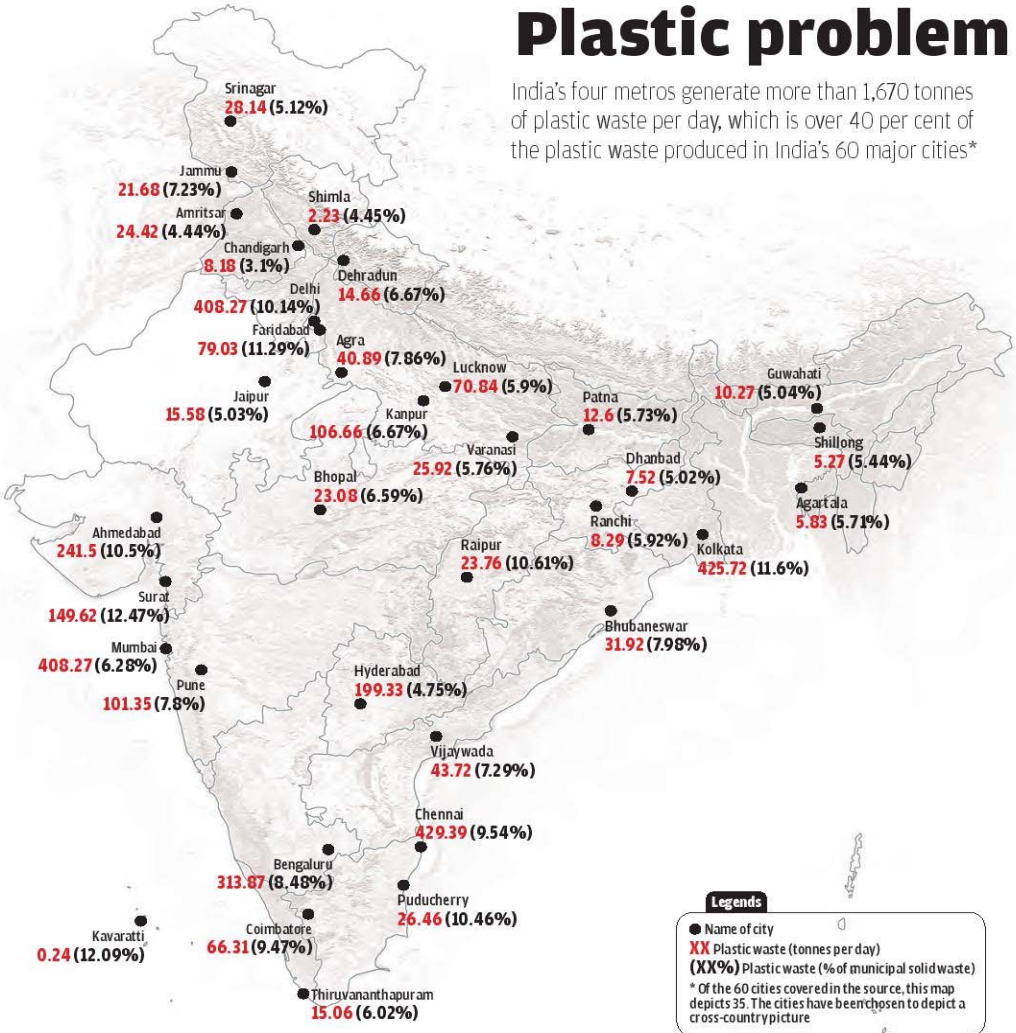
APPENDIX – A

WORLD ENVIRONMENT DAY SPECIAL

Plastic problem

India's four metros generate more than 1,670 tonnes of plastic waste per day, which is over 40 per cent of the plastic waste produced in India's 60 major cities*



Average plastic waste generation in India (tonnes per day)
4,059.18

Average plastic waste share in municipal solid waste in India
6.92%

Legends

- Name of city
- XX Plastic waste (tonnes per day)
- (XX%) Plastic waste (% of municipal solid waste)

* Of the 60 cities covered in the source, this map depicts 35. The cities have been chosen to depict a cross-country picture

Prepared by DTE/CSE Data Centre
Infographics: Raj Kumar Singh
Analysis: Snigdha Das
Source: Consolidated Guidelines for Segregation, Collection and Disposal of Plastic Waste, CPCB, September 2017
For more such infographics visit: *www.downtoearth.org.in/infographics*

Table: Plastic Waste Generation in Sixty Major Cities of India (2010-2012)

S. No.	Name of City	Total Municipal Solid Waste (Tonnes per day)	Plastic Waste (Percentage of Municipal Solid Waste)	Plastic Waste (Tonnes per day)
1.	Kavaratti	2	12.09	0.24
2.	Dwarka	18	8.08	1.45
3.	Daman	25	4.64	1.16
4.	Panjim	25	4.47	1.12
5.	Gangtok	26	8.95	2.33
6.	Jamshedpur	28	3.36	0.94
7.	Silvassa	35	6.11	2.14
8.	Port Blair	45	10.07	4.53
9.	Kohima	45	5.01	2.26
10.	Shimla	50	4.45	2.23
11.	Meerut	52	6.42	3.34
12.	Gandhinagar	97	4.81	4.66
13.	Shillong	97	5.44	5.27
14.	Itanagar	102	5.35	5.46
15.	Agartala	102	5.71	5.83
16.	Aizwal	107	7.95	8.50
17.	Imphal	120	5.13	6.16
18.	Ranchi	140	5.92	8.29
19.	Kochi	150	6.29	9.43
20.	Dhanbad	150	5.02	7.52
21.	Guwahati	204	5.04	10.27
22.	Asansol	210	6.01	12.62
23.	Dehradun	220	6.67	14.66
24.	Patna	220	5.73	12.60
25.	Raipur	224	10.61	23.76
26.	Rajkot	230	6.93	15.93
27.	Thiruvananthapuram	250	6.02	15.06
28.	Pondicherry	250	10.46	26.15
29.	Chandigarh	264	3.10	8.18
30.	Jammu	300	7.23	21.68
31.	Jaipur	310	5.03	15.58
32.	Vishakhapatnam	334	9.03	30.17
33.	Nashik	350	5.82	20.38
34.	Bhopal	350	6.59	23.08

35.	Allahabad	350	5.39	18.86
36.	Jabalpur	400	5.18	20.70
37.	Bhubaneswar	400	7.98	31.92
38.	Madurai	450	5.06	22.77
39.	Varanasi	450	5.76	25.92
40.	Agra	520	7.86	40.89
41.	Srinagar	550	5.12	28.14
42.	Amritsar	550	4.44	24.42
43.	Vadodara	600	4.57	27.41
44.	Vijayawada	600	7.29	43.72
45.	Nagpur	650	7.07	45.96
46.	Coimbatore	700	9.47	66.31
47.	Faridabad	700	11.29	79.03
48.	Indore	720	8.81	63.40
49.	Ludhiana	850	5.96	50.68
50.	Surat	1200	12.47	149.62
51.	Lucknow	1200	5.90	70.84
52.	Pune	1300	7.80	101.35
53.	Kanpur	1600	6.67	106.66
54.	Ahmedabad	2300	10.50	241.50
55.	Kolkata	3670	11.60	425.72
56.	Bangalore	3700	8.48	313.87
57.	Hyderabad	4200	4.75	199.33
58.	Chennai	4500	9.54	429.39
59.	Mumbai	6500	6.28	408.27
60.	Delhi	6800	10.14	689.52
	Total MSW	50592		
	Average PW generation		**6.92**	**4059.18**

Source: Report "Consolidated Guidelines for Segregation, Collection and Disposal of Plastic Waste" made in 2017 by CPCB

APPENDIX – B

Questionnaire

Name of the Village:

Person In charge: **Phone No.:**

1. What is the total population of this region?

2. How many years have you been collecting waste in this municipality?

3. Do you collect garbage only from the households, or even from the roadside?

4. How many people are employed for garbage collection?

5. How much does each household pay towards garbage collection?

6. What are the wages of the garbage collectors?

7. The government has taken an initiative to segregate waste at the source. Are people following this?

8. Could you tell me a bit about the different types of plastics you come across?

	Useful (10)		Price (14)
	Qty	Yes	No.
a) Medicine bottles			
b) Plastic water cups			
c) Soft Drink bottles (Sprite/7 Up/Pepsi etc)			
d) Water bottles			
e) Mixed plastic items – dolls, oil and shampoo bottles			
f) Straws			
g) Tablet covers			
h) Silver coated covers			
i) Printed plastic			
j) Milk Packets			

k) PP covers
l) Carry bags
m) LD print
n) CD covers
o) Footwear
p) Sanitary pads, Diapers
q) LED bulbs
r) Electrical Wire
s) PVC/HDPE Pipes (Usually seen only in the Municipalities)

9. How much plastic do you collect in a month?

10. Out of all the plastic you get, what's useful to you and what isn't?

11. Has the quantity of plastic you get increased or decreased over the years? If so, by how much?

12. Which plastic has the most demand?

13. Which plastic has the least demand?

14. What price do you get for the plastics?

15. Who are your customers?

16. How much profit do you make?

Thank you

APPENDIX – C

PANCHAYATH NAME: MUNDKOOR Total HH Covered : 105, Commercials : 200

SL.NO	INORGANIC RECYCLABLE ITEMS in Kg's	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Plastic Items	240	358	256	332	420	327	365	359	2657	332
2	Plastic Covers	150	190	125	138	264	169	152	175	1363	170
3	Papers	15	9	23	29	34	17	26	18	156	20
4	Card boards	158	167	124	205	161	182	191	101	1289	161
5	Tetra packs	15	11	27	31	40	58	49	63	279	35
6	Glass bottles	388	251	387	410	456	471	499	466	3328	416
7	Broken glasses	2	3	6	2	4	1	0	1	19	2
8	Metals	15	24	13	22	19	16	27	28	164	21
	TOTAL		**1013**	**961**	**1169**	**1398**	**1241**	**1309**	**1211**	**9255**	**1157**

SL.NO	NON RECYCLABLE ITEMS	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	8	11	14	20	14	8	12	9	96	12
2	Footwear	5	7	6	3	4	0	1	1	27	3
3	Cloth items	10	8	6	11	7	7	10	12	71	9
4	Bulbs	1	0	1	2	1	2	1	2	10	1
	TOTAL	**24**	**26**	**27**	**36**	**26**	**17**	**24**	**24**	**204**	**26**

PANCHAYATH NAME : VANDSE Total HH Covered : 708, Commercials : 164

SL. NO	INORGANIC RECYCLABLE ITEMS in Kg's	Sep -17	Oct -17	Nov -17	Dec -17	Jan -18	Feb -18	Mar -18	Apr -18	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec-18	TOTAL	Average
1	Plastic Items	59	173	175	246	308	346	355	376	280	300	250	320	300	410	400	350	4647	290
2	Plastic Covers	52	225	161	192	304	368	389	496	350	280	250	300	300	320	280	350	4615	288
3	Papers	47	188	185	184	279	254	296	490	240	300	180	210	280	300	310	210	3952	247
4	Card boards	127	309	187	327	379	382	362	451	600	580	620	500	600	680	580	730	7414	463
5	Tetra packs									250	200	150	100	250	280	220	150	1600	100
6	Glass bottles	32	339	355	249	730	608	511	55	620	680	500	550	600	620	600	680	7728	483
7	Broken glasses	23	115	96	199	365	97	79	650	318	350	400	450	480	350	300	450	4722	295
8	Metals	23	32	26	43	802	83	67	69	48	52	44	40	50	58	33	47	1517	95
9	E- waste	10	8	6	21	12	9	8	9	350	150	100	180	120	250	300	280	1812	113
	TOTAL	**373**	**1389**	**1190**	**1460**	**3178**	**2146**	**2066**	**2595**	**3056**	**2892**	**2494**	**2650**	**2980**	**3268**	**3023**	**3247**	**38007**	**2375**

SL. NO	NON RECYCLABLE ITEMS	Sep-19	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	19	36	37	34	52	57	53	50	58	60	66	59	48	66	58	61	814	51
2	Thermocol	4	6	4	19	12	8	8	10	15	0	0	10	17	0	0	25	137	9
3	Footwear	46	39	40	97	99	104	100	2	250	300	450	21	30	33	10	22	1643	103
4	Rubber items	3	6	14	10	9	5	15	2	5	0	10	0	0	0	6	0	85	5
5	Leather items	3	2	2	6	1	28	0	241	0	0	10	5	0	0	7	5	310	19
6	Cloth items	38	110	51	56	109	202	160	72	280	150	180	250	300	280	200	150	2588	162
7	Bulbs	3	5	1	45	8	11	18	88	80	0	10	20	22	0	0	12	323	20
8	Ceramic & Melamine	1	2	26	7	24	0	0	0	0	0	10	0	0	0	11	0	81	5
	TOTAL	**116**	**206**	**174**	**273**	**314**	**416**	**354**	**465**	**688**	**510**	**736**	**365**	**417**	**379**	**292**	**275**	**5980**	**374**

SL. NO	Sanitary Items in Kg's	Sep -17	Oct -17	Nov -17	Dec -17	Jan -18	Feb -18	Mar -18	Apr -18	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18	TOTAL	Average
1	sanitary napkins, Condoms, Children and elderly diapers	6	15	11	16	43	73	42	40	15	10	21	15	8	6	10	22	352	22

SL. NO	ORGANIC ITEMS in Kg's	Sep -17	Oct -17	Nov -17	Dec -17	Jan -18	Feb -18	Mar -18	Apr -18	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18	TOTAL	Average
1	Fruits and Vegetables	159	656	458	398	440	355	455	481	450	400	480	420	350	200	350	400	6452	403
2	organic items (Compost)	582	1474	1004	1234	1231	1422	1508	1485	930	900	850	720	250	680	720	950	15941	996
3	Tender Coconuts	477	2245	1062	646	601	454	413	344	190	150	210	220	180	250	120	280	7841	490
4	Coconut Shells	2	13	22	18	160	21	24	15	156	130	99	130	110	180	210	120	1410	88
5	Citric fruit skins	11	57	62	69	957	63	58	39	61	20	18	43	40	51	49	61	1659	104
6	Gents Hair	4	9	11	18	16	19	10	23	24	10	0	18	20	15	21	15	233	15
7	Paper & mixed compost	210	879	947	1121	734	1294	1005	967	25	30	21	15	18	20	22	25	7333	458
	TOTAL	**1445**	**5333**	**3566**	**3504**	**4139**	**3628**	**3474**	**3354**	**1836**	**1640**	**1678**	**1566**	**968**	**1396**	**1492**	**1851**	**40870**	**2554**

PANCHAYATH NAME: VARAMBALLI Total HH Covered : 450, Commercials : 450

SL. NO	INORGANIC RECYCLABLE ITEMS in Kg's	Nov -17	Dec -17	Jan -18	Feb -18	Mar -18	Apr -18	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18	TOTAL	Average
1	Plastic Items	458	554	380	318	594	662	316	802	466	484	480	642	498	465	7119	508
2	Plastic Covers	359	421	436	349	423	385	246	504	332	280	290	552	447	760	5783	413
3	Papers	818	1025	931	862	1017	819	377	1029	597	716	627	960	711	883	11371	812
4	Card boards	1002	890	951	975	901	598	354	1248	945	1112	1008	1058	1132	1136	13310	951
5	Tetra packs	178	110	161	118	121	120	97	165	95	83	170	101	770	93	2383	170
6	Glass bottles	193	158	101	53	100	92	44	104	78	91	103	70	64	92	1343	96
7	Broken glasses	94	44	48	28	22	34	14	41	27	40	25	22	7	28	475	34
8	Metals	85	67	67	64	76	85	51	87	69	59	68	211	55	68	1111	79
9	Aluminium foils	3	6	10	7	11	18	34	21	5	8	5	11	12	12	162	12
10	E- waste	35	24	33	15	14	18	7	28	28	13	28	15	21	12	292	21
	TOTAL	**3226**	**3299**	**3118**	**2790**	**3279**	**2830**	**1539**	**4030**	**2642**	**2886**	**2804**	**3642**	**3717**	**3549**	**43350**	**3096**

SL. NO	NON RECYCLABLE ITEMS	Nov -17	Dec -17	Jan -18	Feb-18	Mar-18	Apr -18	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18	TOTAL	Average
1	MLP'S	47	57	45	44	56	44	38	47	34	29	27	30	22	28	548	39
2	Thermocole	16	24	20	15	24	29	10	21	15	12	38	15	18	19	276	20
3	Footwear	101	97	84	94	98	86	44	164	97	96	86	101	132	102	1383	99
4	Rubber items	20	38	11	8	7	6	2	8	7	5	3	5	6	7	135	10
5	Leather items	33	40	80	82	65	67	38	85	68	60	52	49	20	33	771	55
6	Cloth items	77	103	82	53	57	54	34	71	32	40	12	30	27	20	692	49
7	Bulbs	8	7	4	5	4	3	1	2	4	3	5	5	4	5	61	4
8	Ceramic & Melamine	3	3	6	6	4	4	2	3	3	3	4	6	3	12	60	4
	TOTAL	**306**	**369**	**333**	**308**	**315**	**292**	**169**	**401**	**260**	**248**	**227**	**241**	**232**	**226**	**3926**	**280**

SL. NO	Sanitary Items in Kg's	Nov -17	Dec -17	Jan -18	Feb -18	Ma r-18	Apr -18	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18	TOTAL	Average
1	sanitary napkins, Condoms,	201	258	258	168	91	108	59	61	40	158	58	210	223	305	2198	157

SL. NO	ORGANIC ITEMS in Kg's	Nov -17	Dec -17	Jan -18	Feb -18	Mar-18	Apr -18	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18	TOTAL	Average
1	Fruits and Vegetables	748	778	603	608	642	816	472	558	408	512	440	625	365	668	8244	589
2	organic items (Compost)	5394	5604	5835	5757	6197	9648	14029	7167	5900	1458	5410	1805	1548	2110	77862	5562
3	Tender Coconuts	577	919	574	668	783	848	1069	1304	1085	1110	1170	1070	1110	1118	13404	957
4	Coconut Shells	63	58	97	73	71	67	10	14	44	28	32	18	16	22	614	44
5	Gents Hair	44	49	60	34	45	0	5	163	37	39	28	10	8	7	528	38
6	Citric fruit skins	294	446	448	468	463	379	173	41							2712	194
7	Paper & mixed compost	701	742	813	473	549	667	395	876	70	205					5491	392
	TOTAL	**7821**	**8597**	**8430**	**8081**	**8749**	**12426**	**16154**	**10123**	**7544**	**3352**	**7080**	**3528**	**3047**	**3925**	**108856**	**7775**

PANCHAYATH NAME: HEBRI Total HH Covered : 200, Commercials : 300

SL. NO	INORGANIC RECYCLABLE ITEMS in Kg's	Dec -17	Jan -18	Feb -18	Mar -18	Apr -18	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18	TOTAL	Average
1	Plastic Items	254	298	269	295	208	118	151	171	177	309	313	265	309	3137	241
2	Plastic Covers	250	279	421	240	231	127	56	190	157	164	197	184	190	2686	207
3	Papers	432	529	520	440	461	355	119	191	201	386	264	387	326	4612	355
4	Card boards	630	741	797	864	769	639	385	733	804	831	983	1464	1184	10823	833
5	Tetra packs	91	137	174	182	130	112	25	156	197	190	296	264	240	2196	169
6	Glass bottles	151	147	88	108	113	192	35	75	68	137	247	171	277	1808	139
7	Broken glasses	14	27	40	23	28	21	26	19	17	7	13	8	10	252	19
8	Metals	63	66	68	78	64	55	14	64	49	91	71	74	71	827	64
9	E- waste	23	40	23	18	22	23	5	22	33	46	40	30	19	345	27
	TOTAL	**1908**	**2264**	**2400**	**2247**	**2026**	**1643**	**816**	**1621**	**1703**	**2161**	**2424**	**2847**	**2626**	**26686**	**2053**

SL. NO	NON RECYCLABLE ITEMS	Dec -17	Jan -18	Feb -18	Mar -18	Apr -18	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18	TOTAL	Average
1	MLP'S	36	68	53	51	46	35	32	12	17	21	16	14	20	421	32
2	Thermion	18	10	13	15	19	17	2	9	15	12	7	11	5	153	12
3	Footwear	98	110	82	88	75	80	33	91	68	83	95	68	61	1031	79
4	Rubber items	16	11	12	11	16	6	1	5	1	5	3	11	4	102	8
5	Leather items	3	29	14	18	15	15	7	1	1	3	0	11	0	117	9
6	Cloth items	150	57	141	26	5	0	0	1	3	3	2	2	2	392	30
7	Bulbs	16	6	3	2	3	4	1	1	7	5	6	2	1	56	4
8	Ceramic & Melamine	2	7	7	9	3	4	1							34	3
	TOTAL	**338**	**298**	**325**	**220**	**182**	**161**	**77**	**120**	**112**	**132**	**129**	**119**	**93**	**2305**	**177**

SL. NO	Sanitary Items in Kg's	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	sanitary napkins, Condoms, Children and elderly diaper	17	57	42	67	66	74	41	42	62	40	79	81	64	732	56

SL. NO	ORGANIC ITEMS in Kg's	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Fruits and Vegetables	806	907	829	861	1009	1133	461	779	925	1075	1224	1044	1261	12314	947
2	Mixed organic items (Compost)	1622	1799	2035	2266	2119	2264	775	1297	1340	1678	1970	1552	1457	22174	1706
3	Tender Coconuts	496	872	819	1020	917	1141	480	203	318	703	504	501	471	8445	650
4	Coconut Shells	32	61	66	72	65	34	10	5	8	7	6	10	11	385	30
5	Citric fruit skins	139	164	123	127	95	90	48	0	0	0	0	0	0	786	60
6	Gents Hair	2	12	11	21	0	0	0	17	19	16	18	20	15	151	12
7	Paper & mixed compost	852	1103	1232	947	1431	853	1343	73	72	77	100	92	77	8252	635
	TOTAL	**3950**	**4918**	**5114**	**5314**	**5635**	**5515**	**3116**	**2374**	**2682**	**3556**	**3822**	**3219**	**3292**	**52507**	**4039**

PANCHAYATH NAME: KARKUNJE Total HH Covered : 300, Commercials : 120

SL.NO	INORGANIC RECYCLABLE ITEMS in Kg's	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Plastic Items	74	124	90	173	280	228	171	1140	163
2	Plastic Covers	75	243	213	221	300	298	208	1558	223
3	Papers	113	179	140	344	185	216	187	1364	195
4	Card boards	344	410	406	476	458	544	489	3127	447
5	Tetra packs	0	56	40	56	40	53	59	304	43
6	Glass bottles	28	261	79	188	206	81	112	955	136
7	Broken glasses	8	221	221	86	10	20	11	577	82
8	Metals	27	33	22	46	50	45	64	287	41
9	E- waste	5	6	6	3	20	15	10	65	9
	TOTAL	**674**	**1533**	**1217**	**1593**	**1549**	**1500**	**1311**	**9377**	**1340**

SL.NO	NON RECYCLABLE ITEMS	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	27	45	44	53	85	110	100	464	66
2	Thermocol	2	7	10	4	11	7	9	50	7
3	Footwear	37	30	35	60	106	67	43	378	54
4	Rubber items	10	16	6	24	40	39	36	171	24
5	Cloths	49	65	41	29	25	21	23	253	36
6	Bulbs	5	1	7	2	12	11	8	46	7
7	Ceramic & Melamine Items	1	2	0	4	0	0	1	8	1
	TOTAL	**131**	**166**	**143**	**176**	**279**	**255**	**220**	**1370**	**196**

SL. NO	ORGANIC ITEMS in Kg's	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Fruits and Vegetables	345	233	127	47	110	6	0	868	124
2	organic items (Compost)	921	1235	1523	1857	1814	1620	2398	11368	1624
3	Tender Coconuts	255	512	0	743	812	650	480	3452	493
4	Coconut Shells	116	8	25	25	34	26	23	257	37
	TOTAL	**1637**	**1988**	**1675**	**2672**	**2770**	**2302**	**2901**	**15945**	**2278**

PANCHAYATH NAME : GANGOLLI Total HH Covered : 570, Commercials : 230

SL.NO	INORGANIC RECYCLABLE ITEMS in Kg's	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Plastic Items	55	242	99	184	180	760	152
2	Plastic Covers	90	120	160	152	172	694	139
3	Papers	45	164	80	120	90	499	100
4	Card boards	28	456	50	195	213	942	188
5	Tetra packs	70	120	90	110	135	525	105
6	Glass bottles	26	75	92	123	115	431	86
7	Broken glasses	12	20	0	80	9	121	24
8	Metals	6	118	3	10	70	207	41
9	E- waste	0	33	14	5	8	60	12
	TOTAL	**332**	**1348**	**588**	**979**	**992**	**4239**	**848**

SL.NO	NON RECYCLABLE ITEMS	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	20	32	45	62	80	239	48
2	Thermocol	3	6	2	2	3	16	3
3	Footwear	10	28	12	8	16	74	15
4	Rubber items	0	35	0	16	8	59	12
5	Cloth items	10	8	10	8	16	52	10
6	Bulbs	0	10	9	8	6	33	7
	TOTAL	**43**	**119**	**78**	**104**	**129**	**473**	**95**

SL. NO	ORGANIC ITEMS in Kg's	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Fruits and Vegetables	168	135	275	290	210	1078	216
2	organic items (Compost)	1123	1692	1425	1960	1425	7625	1525
3	Tender Coconuts	10	6	14	8	11	49	10
4	Coconut Shells	5	10	3	6	5	29	6
6	Gents Hair	8	15	6	10	6	45	9
7	Paper & mixed compost	12	25	30	18	15	100	20
	TOTAL	**1326**	**1883**	**1753**	**2292**	**1672**	**8926**	**1785**

PANCHAYATH NAME: SIDDAPUR Total HH Covered : 67, Commercials : 325

SL.NO	INORGANIC RECYCLABLE ITEMS in Kg's	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Plastic Items	146	145	155	122	114	682	136
2	Plastic Covers	251	200	172	177	187	987	197
3	Papers	210	155	137	171	123	796	159
4	Card boards	553	354	295	278	461	1941	388
5	Tetra packs	149	174	187	193	231	934	187
6	Glass bottles	105	151	93	67	103	519	104
7	Broken glasses	9	25	18	12	25	89	18
8	Aluminium foils	0	0	0	1	0	1	0.20
9	E- waste	16	14	16	24	19	89	18
	TOTAL	**1439**	**1218**	**1073**	**1045**	**1263**	**6038**	**1208**

SL.NO	NON RECYCLABLE ITEMS	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	60	49	54	43	48	254	51
2	Thermocol	5	5	7	11	2	30	6
3	Footwear	7	55	49	57	56	224	45
4	Rubber items	24	61	61	32	51	229	46
5	Cloth items	35	39	44	92	106	316	63
6	Ceramic & Melamine	0	12	6	1	1	20	4
	TOTAL	**131**	**221**	**221**	**236**	**264**	**1073**	**215**

PANCHAYATH NAME: AMASEBAIL Total HH Covered : 30, Commercials : 120

SL.NO	INORGANIC RECYCLABLE ITEMS in Kg's	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Plastic Items	42	46	62	44	194	49
2	Plastic Covers	68	62	72	72	274	69
3	Papers	100	98	95	107	400	100
4	Card boards	195	216	255	314	980	245
5	Tetra packs	58	42	32	34	166	42
6	Glass bottles	51	68	93	30	242	61
7	Metals	48	58	88	60	254	64
8	E- waste	10	22	8	10	50	13
	TOTAL	**572**	**612**	**705**	**671**	**2560**	**640**

SL.NO	NON RECYCLABLE ITEMS	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	9	18	22	9	58	15
2	Thermocol	1	1	1	2	5	1
3	Rubber items	1	1	4	4	10	3
4	Cloth items	10	21	25	7	63	16
	TOTAL	**21**	**41**	**52**	**22**	**136**	**34**

PANCHAYATH NAME: HANGALUR Total HH Covered : 150, Commercials : 30

SL.NO	INORGANIC RECYCLABLE ITEMS in Kg's	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Plastic Items	15	23	21	11	13	21	20	124	18
2	Plastic Covers	25	29	67	51	22	43	44	281	40
3	Papers	8	15	23	19	10	12	13	100	14
4	Card boards	11	13	25	20	9	6	19	103	15
5	Tetra packs	0	1	0	1	2	1	1	6	1
6	Glass bottles	15	28	45	90	101	99	127	505	72
7	Broken glasses	10	18	14	27	11	9	10	99	14
8	Metals	4	9	11	6	5	18	10	63	9
9	E- waste	1	1	3	7	5	8	8	33	5
	TOTAL	**89**	**137**	**209**	**232**	**178**	**217**	**252**	**1314**	**188**

SL.NO	NON RECYCLABLE ITEMS	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	8	7	10	9	14	17	15	80	11
2	Footwear	18	26	55	69	51	27	54	300	43
3	Leather items	1	2	1	2	2	2	8	18	3
4	Cloth items	0	1	0	1	1	7	8	18	3
5	Bulbs	5	7	8	6	10	5	5	46	7
	TOTAL	**32**	**43**	**74**	**87**	**78**	**58**	**90**	**462**	**66**

PANCHAYATH NAME: TRASI , HOSADU Total HH Covered : 150, Commercials : 300

SL.NO	INORGANIC RECYCLABLE ITEMS in Kg's	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Plastic Items	65	182	199	190	302	103	1041	174
2	Plastic Covers	108	125	150	161	174	168	886	148
3	Papers	30	40	69	43	65	39	286	48
5	Card boards	201	120	232	175	182	235	1145	191
6	Tetra packs	45	120	116	202	215	230	928	155
7	Glass bottles	35	280	300	450	300	450	1815	303
8	Broken glasses	251	150	175	230	278	168	1252	209
9	Metals	68	50	75	35	48	50	326	54
11	E- waste	0	2	5	8	7	4	26	4
	TOTAL	**803**	**1069**	**1321**	**1494**	**1571**	**1447**	**7705**	**1284**

SL.NO	NON RECYCLABLE ITEMS	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	80	170	210	150	185	150	945	158
2	Thermocol	0	0	0	0	0	85	85	14
3	Footwear	5	8	3	5	6	8	35	6
4	Rubber items	15	40	35	25	75	45	235	39
5	Leather items	30	40	50	65	45	35	265	44
6	Cloth items	12	0	3	8	7	12	42	7
7	Bulbs	0	0	0	0	0	12	12	6
	TOTAL	**142**	**258**	**301**	**253**	**318**	**347**	**1619**	**270**

SL.NO	Sanitary Items in Kg's	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Sanitary napkins, Condoms, Children and elderly diapers	10	25	20	24	23	21	123	21

SL. NO	ORGANIC ITEMS in Kg's	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	organic items (Compost)	120	320	360	882	850	875	3407	568
2	Tender Coconuts	0	5	8	12	9	16	50	8
3	Citric fruit skins	10	25	28	30	32	38	163	27
4	Gents Hair	0	15	18	10	22	21	86	14
5	Paper & mixed compost	16	35	39	42	27	35	194	32
	TOTAL	**146**	**400**	**453**	**976**	**940**	**985**	**3900**	**650**

PANCHAYATH NAME :KOKKARNE Total Shops : 175, Houses: 75

SL.NO	INORGANIC RECYCLABLE ITEMS in Kg's	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Plastic Items	50	61	74	40	225	56
2	Plastic Covers	32	43	49	73	197	49
3	Papers	120	164	180	130	594	149
4	Papers Cup	0	1	3	2	6	2
5	Card boards	190	214	389	324	1117	279
6	Metals	1	2	1	1	5	1
	TOTAL	**393**	**485**	**696**	**570**	**2144**	**536**

SL.NO	NON RECYCLABLE ITEMS	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	18	22	29	32	101	25
2	Thermocol	1	1	1	2	5	1
3	Footwear	150	169	240	141	700	175
4	Rubber items	7	4	8	11	30	8
5	Cloth items	45	56	64	35	200	50
6	Bulbs	0	1	0	1	2	1
	TOTAL	**221**	**253**	**342**	**222**	**1038**	**260**

PANCHAYATH NAME :MARAVANTHE Total HH Covered : 700, Commercials : 100

SL. NO	INORGANIC RECYCLABLE ITEMS in Kg's	May -18	Jun -18	Jul -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18	TOTAL	Average
1	Plastic Items	137	75	14	91	89	84	90	187	767	96
2	Plastic Covers	117	111	35	26	112	60	50	70	581	73
3	Papers	92	43	6	4	44	50	66	135	440	55
4	Papers Cup	9	15	11	16	22	20	22	24	139	17
5	Card boards	205	180	200	79	126	120	110	250	1270	159
6	Tetra packs	15	18	18	40	40	39	42	50	262	33
7	Glass bottles	116	120	17	45	67	60	62	70	557	70
8	Broken glasses	10	12	8	7	6	4	8	8	63	8
9	Metals	13	15	10	25	29	12	18	21	143	18
10	Aluminium foils	0	1	1	1	2	1	3	2	11	1
11	E- waste	3	1	5	4	5	4	5	5	32	4
	TOTAL	**717**	**591**	**325**	**338**	**542**	**454**	**476**	**3443**	**4265**	**533**

SL.NO	NON RECYCLABLE ITEMS	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	14	14	17	5	34	17	18	22	141	18
2	Thermocol	10	12	10	9	3	7	4	5	60	8
3	Footwear	39	40	38	30	42	52	40	45	326	41
4	Cloth items	23	0	4	1	3	32	33	10	106	13
5	Bulbs	3	1	1	3	2	1	10	2	23	3
6	Ceramic & Melamine	1	2	1	1	1	1	3	5	15	2
	TOTAL	90	69	71	49	85	110	108	89	671	84

SL.NO	Sanitary Items in Kg's	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	sanitary napkins, Condoms, children and elderly diapers	15	26	20	30	19	26	18	10	164	21

SL. NO	ORGANIC ITEMS in Kg's	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	organic items (Compost)	150	250	200	400	250	300	163	150	1863	233
2	Tender Coconuts	20	31	53	79	71	80	83	78	495	62
3	Coconut Shells	1	4	3	3	5	4	2	2	24	3
4	Gents Hair	0	0	5	5	6	5	5	5	31	4
5	Paper & mixed compost	90	85	76	101	85	100	93	104	734	92
	TOTAL	**261**	**370**	**337**	**588**	**417**	**489**	**346**	**339**	**3147**	**393**

PANCHAYATH NAME: HARDALLI MANDALLI Total HH Covered : 200, Commercials : 150

SL.NO	INORGANIC RECYCLABLE ITEMS in Kg's	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Plastic Items	82	90	111	110	112	130	635	106
2	Plastic Covers	42	49	60	64	80	85	380	63
3	Papers	38	40	61	49	50	60	298	50
4	Card boards	133	150	151	160	170	171	935	156
5	Tetra packs	50	70	90	94	90	91	485	81
6	Glass bottles	25	31	40	46	17	15	174	29
7	Broken glasses	5	7	7	7	6	7	39	7
8	Metals	17	16	17	18	17	24	109	18
9	E- waste	3	3	4	3	4	3	20	3
	TOTAL	**395**	**456**	**541**	**551**	**546**	**586**	**3075**	**513**

SL.NO	NON RECYCLABLE ITEMS	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	MLP'S	4	5	6	5	6	6	32	5
2	Thermocol	2	3	2	2	2	1	12	2
3	Footwear	10	13	12	14	15	14	78	13
4	Rubber items	3	4	3	4	5	4	23	4
5	Leather items	5	5	4	3	4	4	25	4
6	Cloth items	31	34	36	34	30	29	194	32
7	Bulbs	1	2	2	3	1	2	11	2
	TOTAL	**56**	**66**	**65**	**65**	**63**	**60**	**375**	**63**

SL.NO	Sanitary Items in Kg's	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	sanitary napkins, Condoms, Children and elderly diapers	26	30	26	35	36	30	183	31

SL. NO	ORGANIC ITEMS in Kg's	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	TOTAL	Average
1	Fruits and Vegetables	352	400	380	410	430	400	2372	395
2	Mixed organic items (Compost)	1246	1300	1400	1300	1500	1550	8296	1383
3	Tender Coconuts	100	200	150	140	300	100	990	165
4	Coconut Shells	20	10	10	7	11	7	65	11
5	Citric fruit skins	10	10	12	12	14	13	71	12
6	Gents Hair	0	0	0	0	0	0	0	0
7	Paper & mixed compost	59	60	72	76	100	94	461	77
	TOTAL	**1787**	**1980**	**2024**	**1945**	**2355**	**2164**	**12255**	**2043**

ABOUT THE AUTHOR

Abisha Soans is an aspiring designer currently studying in Class 12 in R. N. S. PU College, majoring in Commerce. Growing up in a Coastal town, she spent many weekends running around on the beach or playing in the sea & was disheartened by the amount of plastic washed up on shore. With increasing consciousness in the ever growing problem of plastic waste, she gravitated towards understanding this messy situation. She went on to delve deeper into this issue by Collaborating with SoanS Corporation who was developing a Prototype machine to convert Waste Plastic to Fuel. She carried out the field research & wrote this paper in the year 2018-2019. Some of the core aspects of her role were case studies based on plastic waste generated in India, particularly in Canara-Karnataka per annum, statistics & analysis samplings & sourcing data from the localities.