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Modern Approach to Waste Management, Success Stories and ongoing Projects in Present Scenario

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Abstract: *In era of 21 century study of environment and pollution has become major concern in developing countries like India. Urbanisation and Industrialisation with huge population drag our attention towards practical problems like Waste Management, their scientific solution also to find possibilities to reuse and recycle them to save our resources and energy. With present knowledge and possible resources we have tried to find some of the optimal solution to Non-Biodegradable waste like plastic (specially waste PET Bottles).*

Also we have find after use solution of products and article. Economical consideration, Social impact, Capacity building and Technical experiments are done during research work on this topic. We have included some success stories and ongoing project summary in this paper to give a brief about waste problem solution. In rural area community is doing great contribution to this nationwide movement.

In our small inspection of some of the major institute, offices, hotels and local areas of Jagdalpur city (Chhattisgarh), we found that major portion of Non-Biodegradable waste are plastic. In which PET waste bottles have big amount of portion, so tried to investigate reuse options to them.

After studying journals, online articles and other internet sources we tried to make Furniture from them. In continuation with that we made two stools and a table shape article with approximately 65 waste bottles. Further for economical consideration we estimated their cost which was below 250 rupee, that falls at lower range of industrial products available on market and online platforms. For finding social impact we estimated how this can affect people? So we found that micro level employment generation can be done with this work with help of local government support it can be extended. Then for technological understanding of work we tested them in CIPET, Raipur which is leading Central institute in our state Chhattisgarh for works related with plastic. We tested our products stool, single leg of table and bottle strength their. Report is discussed in respective section below.

Keywords: *Biodegradable, Non-Biodegradable, Waste, kachara, PET bottles, swacchata, SHGs, Furniture, Reduce, Reuse, Recycle.*

I. INTRODUCTION

Plastic has social, technical and economic effects. Its waste problem is multidimensional. It cannot be solved by only one stream. All the together approach by management, chemistry, biological treatment and engineering technical solution ideas keeping in mind with after use affects, can solve this.

Plastic is designed to be durable, which generates problem after use, and becomes a tough job to reduce this by self like other biodegradable waste. Developing new methods are important.

These days wind turbine are using composite material made from fiberglass and carbon fiber, which is obtained from recyclable plastic. They exhibit high level of strength as well as thermal resistance. Study done in USA shows that HDPE production is highest and only 10% gets recycled, PET stands at second position based on production. Its 19% gets recycled. 5% LDPE, 0.5% PP, 0.9% PS and 0% PVC gets recycled.^[1]

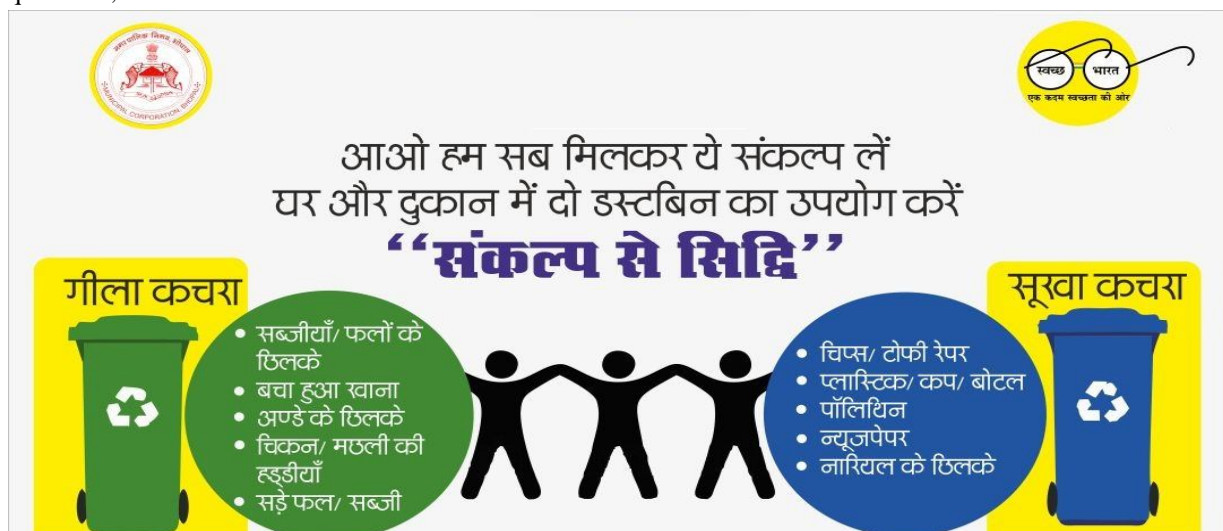
All plastic are not easily recyclable. Polyethylene polymers are easy to handle. High density polymers can be used to make new low quality materials like carpet fiber etc. Pyrolysis can solve PS problem to some extent. During this process product gets vaporized as the polymer breaks down, after the condensation oil and gas is obtained. But in some states of India govt is putting hard restrictions on these plants because of high level of pollution generation. Also toxic gases and smell around these plants are so harmful for civilians.^{[2] [3]}

II. GENERAL SOLUTION TO PROBLEM

Solution for waste: three R's can help us to cut down amount of waste we throw away. They conserve natural resources also saves money. [4]



- 1) *Reduce*: reduce the use as well as the production. If there is less generated, less used then there will be less waste problem. Using multi use items is essential to beginning reduction. The waste should be disposable. Always make sure what you use. Some daily life tips are-Print on both side of paper, use old PET bottles again, use old paper for packaging, use metallic foil for packaging in place of plastic, avoid buying single use products, use cotton bags in place of plastic ones.
- 2) *Reuse*: find a creative way to reuse them. We can use them again for other purpose. It can help in reducing waste. By this method biodegradable and non degradable, both waste can be handled. This may not need proper technological knowledge, but with help of technical support better products and reuse works can be done at huge level. Mass production can also be achieved by this method, because it needs manpower to convert waste into other new refurbished products. Example are- we made plastic stool from waste PET bottles, tyre can be used to make swing etc.
- 3) *Recycling*: this is a complete industrial process needs technological support, investment and a proper procedure. These plants are generally setup near municipal cities, where waste generation is high as well as proper rate of raw material availability can be maintained. Examples are- metal recycling, plastic is converted into fiber or flakes, non toxic activities, paper to make handicraft and recycled rough A new term can be added here in today's era that is *Educate*.
- 4) *Educate*: There are large no of NGOs which can be used to promote waste management awareness. Women, children can contribute best in this work. Working with local teachers, activists, local politicians, renowned people can establish a pilot programme. Also in school syllabus these topics are being covered. By exhibition, competition reward they can be motivated. In rural areas where people are less educated and aware, govt is using coloured buckets for separate waste. Which is solid and in liquid state, termed as "Geela kachra" and "Sookha kachra".





III.SOME SUCCESS STORIES AND MODERN APPROACH

1) *Plastic House:* .In Africa plastic bottle house is being made. In India also many projects are ongoing^[5]



- 2) *Plastic Man*: Rajagopalan Vasudevan a 73 year old Madurai based professor known as “Plastic Man”. Come out with a patented method to reuse plastic waste to make road. The methods has used to make around 5000 km road across the country. He was awarded by Padma Shri by Government of India. The fourth highest civilian award of country. For 1km 3.75m wide road 1 tonne of plastic approx. 10 lakh carry bags were used. And 1 tonne bitumen was saved as well as 1 tonne of plastic waste got reused. Each 1 tonne of plastic waste avoids 3 tonnes of CO₂ emission.^[6]
- 3) *Ambikapur city of Sarguja district of our Chhattisgarh*: It won the Best city in innovation and best practices award in 1-3 lakh population category.^[7]. Its overall national rank was 11 and 1 in state. Chhattisgarh got 3rd rank in best performing state. Women Self Help Groups (SHGs) are generating hundreds of green jobs without big investment. They are registered under society called “ Swachh Ambikapur Mission Sahakari Samiti Maryadit”. Each worker is earning approximately 5000 rupees a month. They are simple to implement donot require high technical support, cost effective in nature, good portion of representation of women, supports urban poor, support waste management, environment friendly. ^[8]
- 4) *Kachra Mahotsav Naya Raipur*: Nation’s first type of its was organized in chhattisgarh. Hwere we focused to change the way to see trash, and convert it to Reuse full products. Where stufents from school, college and community from people gave their ideas by exhibition. This was promoted on social media with hastag of #BeatPlasticPollution. This gave emphasis on non biodegradable waste specially. In present time municipal corporation is trying to spread awareness with tag of #MorZimmedari in people of Chhattisgarh, in Chhattisgarhi language. It is a good step to connect youth with social media which will help to increase number of people connected to this noble cause.^{[9][10]}





Image credit: Municipal Corporation Ambikapur

- 5) *Dantewada Women Groups*: in rural area of Dakshin Bastar Dantewada district women group namely “Sagar Samooh”, “Shankini Samooh”, “Roshini Samooh” are making carrybags from waste paper collected from offices and newspaper. They are using simple techniques and help of 5-10 women approx. to convert this waste to usefull product. Due to less demand and marketing and lack regular demand they are not generating profit right now. With help of local shopkeepers and local body suppot they can give tremendous results in this area. Above details was concluded from meeting with the head of this group Smt. Ahalya Chandrawasnhi Ji, with the author at their workplace in Dantewada. They are making carrybags of 250 gm, 500 gm and 1kg capacity. The price ranges from 45-50 Rupee per kg of carrybag bundle. They are very good in quality and reliable.



- 6) *Furniture Making*: we will make some reuse products like stool and table from PET waste bottles. Steps of making with pictures and cost calculations are given below. Cost calculations are done on the basis of product availability and their market cost, which may vary city to city as well as their price may go lower when person will buy them in bulk. Requirement: 19-20 PET waste bottles, Glue, Tape, Plywood sheet, Thermocol or cloth strips or cotton to make cushion, and printed cover for making outer portion. Cost of making: Special mention that, these costs are calculated as per market value of the product which was purchased. Quantity of glue, length of tape used, are also calculated roughly by inspection of used and unused portion level. Their use can also vary as per the person making it, his technical skills, ability and knowledge. Costs may vary city to city as well as when these products will be bought in bulk, prices may go much lower also.

Table: Cost Estimation Of Stool-A

S No.	Part	Quantity	Cost per Unit in ₹	Total Cost in ₹
1	PET waste Bottles	19 piece	1	19
2	Plywood	1520 cm ²	0.03027347 per cm ²	46
3	Glue(HEXON-800)Synthetic Rubber solution	200 ml	0.25 per ml	50
4	Tape	20 meters	0.50 per meter	10
5	Thermocol	5664 cm ²	0.00897021	50
6	Outer finishing	5664 cm ²	N/A	50 (depends upon personal choice)
TOTAL COST				225

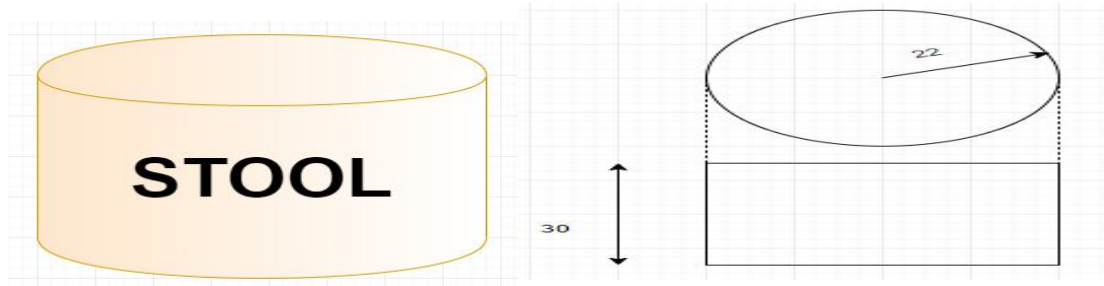




TABLE: Requirement: 32 PET waste bottles, Glue, Tape, Plywood sheet, Sunmica Cost of making

TABLE: Cost of making TABLE from Bottles

S No.	Part	Quantity	Cost per Unit in ₹	Total Cost in ₹
1	PET waste Bottles	32 piece	1	32
2	Plywood(Top+4 Plates)	$(4650+3456)=8106$ cm^2	0.03027347 per cm^2	245
3	Glue(HEXON-800)Synthetic Rubber solution	400 ml	0.25 per ml	100
4	Tape	40 meters	0.50 per meter	20
5	Plastic table cover	4650 cm^2	0.011039964 ₹ per cm^2	52
6	Thermocol top cover(Non Flexible Cheaper one used)	4650 cm^2	40 per sheet	40 (depends upon personal choice)
7	Pipe to connect Bottles	160 cm	0.1 per cm	16
8	Nuts, Bolts and Washer	350 gm(8 set)	0.1 per gm	35
TOTAL COST				540

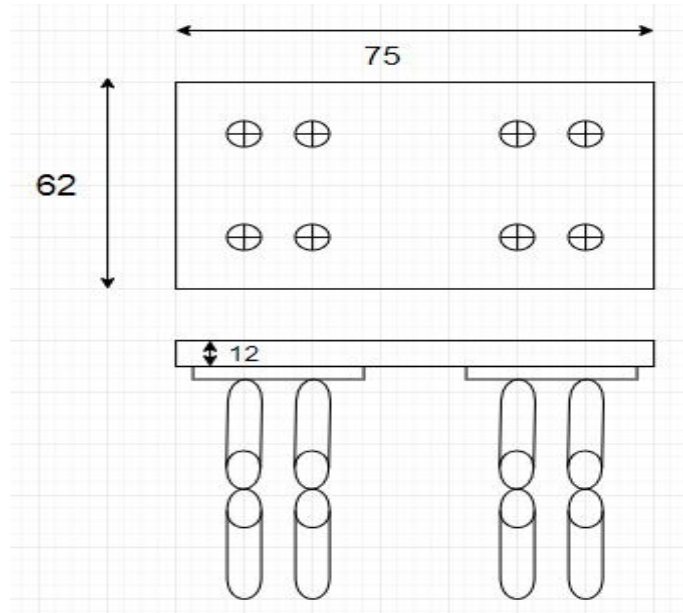


Fig. : Layout of Table made from waste plastic bottles



A. Testing of Furnitures

TEST RESULTS: Stool and One lag of table made from waste PET bottles were tested in Central Institute of Plastic Engineering and Technology (CIPET), Raipur. Peak load and Strain percentage graph plots are generated by UTM testing machine. With cell load of 100KN speed of 1.6 mm/min. Summary of Test results are as bellow –

Table: UTM Testing Results

S No	NAME OF TEST	METHOD	PEAK LOAD (in N)	PEAK LOAD (in k. g.)
1	Compressive load on Stool of waste bottle	ASTM D695	3735	380.85
2	Compressive load on a single leg of table made by waste bottle	ASTM D695	216	22.02
3	Green cold drink 2.25 Litre bottle (better strength)	ASTM D695	200	20.39
4	Waste Water 1 Litre Bottle (low strength)	ASTM D695	73	7.74

Final reuse products from waste plastic bottles:



Image courtesy: GEC Jagdalpur.

IV. CONCLUSION

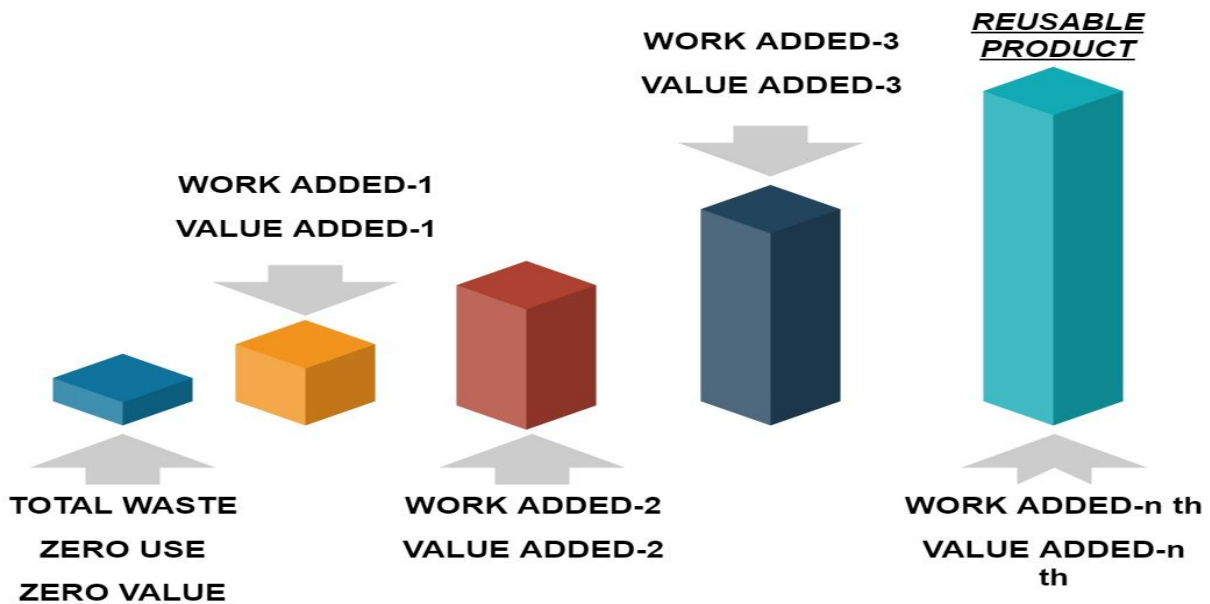
We made Stool-1 from 19 waste bottles, and one more Stool-2 from 14 waste oil bottles and Table from 32 waste bottles. Means we saved total of 65 bottles from going to sewerage or Land-Fills. If these products will give us 1.5 to 2 year of working life it simply means we are stopping huge amount of plastic going towards Landfills, or oceans, which will provide some time to our scientists and international research organizations to find better Recycle methodology as well as our Government to setup mechanism and awareness environment for this work. This is also going to create a opportunity to start a Micro level Industry with very minimal investment and skills to make these types of usable products from waste, which will generate revenue also from the waste having zero cost at dustbin standing at corner of the road. With lots of possibilities around and ahead we have submitted this project with a new sort of idea and creativity to sustainable development of our society.

Normally cushioned and non-cushioned stools are available at price range of 400 to 2000 Rupee at various online platforms. Our one stool costs us below 300 Rupee. With respect to finishing, strength, better design, reliability and life span of industrial stool, our product justifies its cost and also possibilities can be further found to reduce final cost. Chhattisgarh state government is going to set up Plastic Park in Rajnandgaon district near Khairjhiti village. It is clear that recycled flakes and fiber will generate a great start-up opportunity in upcoming future in our state which is made from non degradable waste.

Our research work can be further extended by finding more Reuse options to other Non-Biodegradable waste which we did not included in detail in our research work. Articles made by us (Stool, Table) can be tested with furniture testing machine for better

technical understanding of possible failures also possibilities can be investigated to reduce overall cost. Also possible ways should be find to solve used metal waste problem. Bio medical waste needs high level of attention and in depth knowledge, that's why we did not included that portion in our work.

With best of our knowledge all these technical, economic and social impacts are investigated in this research project. Which justifies our contribution to society with technological knowledge we have gained. Also we have tried to find some of future scope regarding to this project, so that further investigation can be done related to this major issue.



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