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WASTE PLASTIC'S GREEN CONSTRUCTION: INTRODUCING THE PROCESS THAT CONVERTS 100% PLASTIC WASTE INTO AN ALTERNATIVE RENEWABLE VARIOUS TYPES OF CONSTRUCTION MATERIALS

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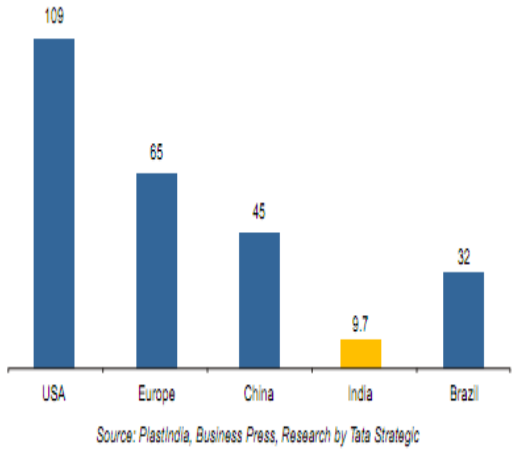
ABSTRACT
High cost of primary requirements for constructing the houses in places on where people are under poverty line, is forming one of the most significant problems of people. On the other hand, urbanization growth will increase rubbish especially non-renewable ones. A suitable approach for this situation is using some part of urban rubbish as required materials for building construction and also providing comfortable situation and suitable thermal for building residents. In this study an effort has been made to review the research works done on plastics by Pandora House Value Chain Management as a various types of construction material, decorating items, gardening replacing traditional materials. Construction activities impact a lot on the environment throughout the life cycle of the project. It is seen that a pet bottle fully filled and compacted with sand achieves a much higher compressive strength than that of a brick. In this study several parameters like thermal study, sound insulation, light transmission, strength parameters, and structural stability have also been reviewed. The reuse of plastics discussed and it can be used in constructing various structures, materials which helps in sustainable development of the society.

KEYWORDS: Plastics, green construction, decorative items, solid waste management, reuse, recycling.

1. Executive Summary of Plastics

Figure 1: Per capita plastic products consumption (Kg/person)



Source: PlastIndia, Business Press, Research by Tata Strategic

A Plastic industry is making significant input to the economic development and expansion of various key sectors in the country such as: Automotive, Construction, Electronics, Health care, Textiles, and FMCG etc. Its require has been growing rapidly. India is currently net importer of Polyethylene (PE). However with the commissioning of IOCL plant at Panipat, the imports are expected to go down significantly. India observes noteworthy regional diversity in expenditure of plastics with Western India accounting for 47%, Northern India for 23% and Southern India for 21%. Bulk of the utilization in Northern India is from end use industries of Auto, packaging (including bulk packaging), plasti-culture applications, electronic appliances etc. which are concentrated mostly in UP and Delhi NCR (>50%). However, plastic processing in other parts like Rajasthan, Punjab, Haryana, Uttarakhand, J&K and Himachal Pradesh are expected to grow based on increased accessibility of feedstock and higher focus on industrialized sector.

The chemical industry is critical for the economic development of any country. Indian chemical sector financial credits for ~13% of the gross value added by the industries sector. With Asia's increasing input to the global chemical industry, India materializes as one of the focus destinations for chemical companies worldwide.

Chemical industry is significant for the economic development of any country as it offers products and solutions for almost all sectors of economy.

Petrochemical products pervade the entire spectrum of daily use items and cover approximately every sphere of life like clothing, housing, construction, furniture, automobiles, household items, agriculture, horticulture, irrigation, packaging, medical appliances, electronics and electrical etc. These industries hence constrain the demand growth of petrochemicals. Current low per capita utilization level of plastic products as evaluated to developed countries per capita using up suggests that India offers a huge opportunity over long term (Figure1).

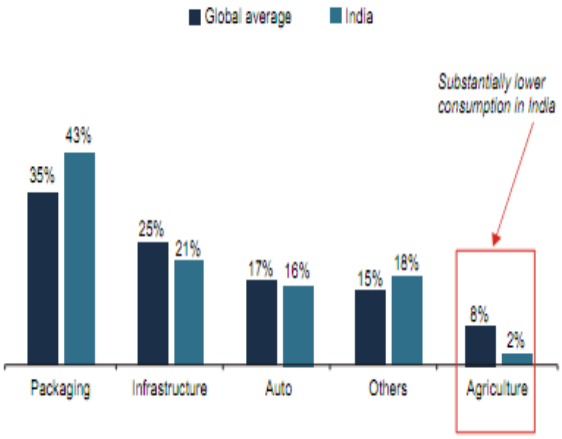
Packaging industry in India has seen a strong penetration of plastics as compared to global standards. However, agriculture sector still hasn't explored the benefits of plastics to a large extent. Global average for plastics demand in agriculture is~8% while India is substantially lower at only 2% (Figure 2).

India offers strong prospect for manufacturing of petrochemicals in future with its plan to increase the share of manufacturing in GDP from 16% to 25% by 2022. The increasing demographic surplus, urbanization, mounting income levels all support a strong case of increase in both demand and supply of petrochemicals in India. Plastic are the foremost item for consumption that report for bulk of the Indian petrochemical industry.

A wide mixture of plastics raw materials are produced to meet the material needs of different sectors of the economy. These polymeric materials are roughly categorized as service, engineering and specialty plastics. Commodity plastics are the most important products that report for bulk of the plastics and in turn for petrochemical industry. Commodity plastics comprise of Poly-ethylene (PE), Poly-propylene (PP), Poly-vinyl Chloride (PVC) and Poly-styrene. While engineering and area of expertise plastics are exhibit superior mechanical and thermal properties in a wide range of conditions over and above more commonly used product plastics and are used for specific purpose.

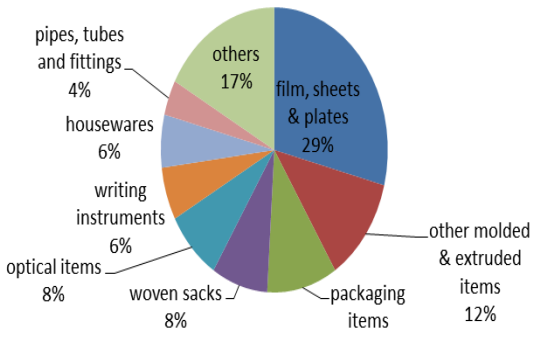
There are three broad types of PE, viz: Low-density Polyethylene (LDPE), High-density Polyethylene (HDPE) and Linear Low-density Polyethylene (LLDPE). Major plastic materials like PE and PP are derived from Ethylene and Propylene respectively, while other plastics such as PVC, PS&ABS and P Care produced from benzene, butadiene and other feedstock.

Figure 2: Polymer utilization by application, Fy13



Major application of plastics in food processing is in packaging (**Figure 3**). Plastics are preferred for its characteristics and versatility of applications. It is light weight, corrosion resistance, moisture proof, highly versatile and can be moulded into attractive shapes. Additionally, packaging standards have become more stringent with introduction of new Indian norm closer to global standards which are also driving the use plastics in packaging.

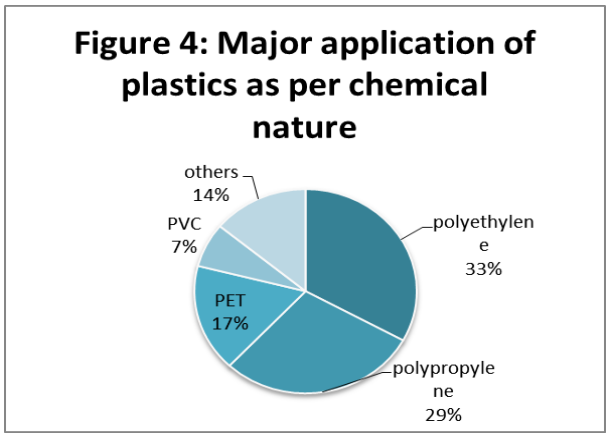
Figure 3: Product wise breakup of plastic products



Group	Typical application	Symbol
PET (polyethylene terephthalate)	Plastic soft drink, sports drink and water bottles. Also used in food containers because it is transparent (so the contents can be seen) and resists breakage	1 PETE
HDPE (high density polyethylene)	Milk, water and juice containers, liquid detergent bottles, laundry soap containers and ice cream containers, bottle caps	2 HDPE
PVC (polyvinyl chloride)	Bottles with handles	3 V
LDPE (low density polyethylene)	Shopping bags, bread bags, frozen food bags, and dry-cleaning bags. Plastic sheeting, packaging film and sheeting	4 LDPE
PP (polypropylene)	Food containers	5 PP
PS (polystyrene)	Food-service applications, grocery-store meat trays, egg cartons, cups, plates. Fresh produce containers. Large packaging	6 PS
Other (multi product/layer)	Specialised packaging products	7 OTHER

2. The Great Plastic Tide

The world inhabitants are living, working, retreating, vacationing, increasingly[2] conglomerating along the coasts, forests, hills, lands and standing on the front row of the greatest, most unprecedented, plastic waste tide ever faced (**Figure 4**). Washed out on our coasts in noticeable and clearly visible form, the plastic pollution spectacle unashamedly unveiling on our locality, roads, beaches is only the prelude of the greater story that unfurled further away in the world's water and land, yet mostly originating from where we stand: the land. For more than 50 years, global manufacture and consumption of plastics have continued to rise. An estimated 299 MTs of plastics were produced in 2013, representing a 4% increase over 2012, and confirming and upward trend over the past years. In 2008, our global plastic burning up universal has been estimated at 260 MTs, and, according to a 2012 report by Global Industry Analysts, plastic consumption is to reach 297.5 MTs by the end of 2015.



Plastic is versatile, lightweight, flexible, moisture resistant, strong, and relatively inexpensive. Those are the attractive qualities that lead us, around the world, to such a insatiable appetite and over-consumption of plastic goods. However, durable and very slow to degrade, plastic materials that are used in the production of so many materials all, ultimately, become waste with staying power.[2] Our tremendous attraction to plastic, coupled with an irrefutable behavioral propensity of increasingly over-consuming, discarding, littering and thus polluting, has become a amalgamation of lethal nature (**Figure 5**).

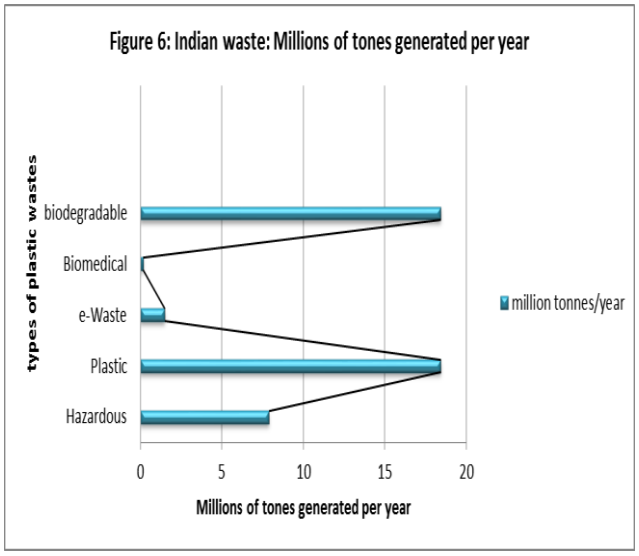
Figure 5: Great plastic tide

A casual walk on any beach, anywhere, and the plastic waste exhibition is present. All over the world the statistics are ever growing, horrifyingly. Tons of plastic debris (which by definition are waste that can vary in size from large containers, fishing nets to microscopic plastic pellets or even particles) is throw away every year, everywhere, polluting lands, rivers, coasts, beaches, and oceans. every year, 8 million MTs of plastic end up in our oceans. It's comparable with five grocery bags filled with plastic for every foot of coastline in the world[2]. In 2025, the annual input is estimated to be about twice greater 10 bags full of plastic per foot of coastline. So the cumulative input for 2025 would be nearly 20 times the 8 million MTs estimate, which is 100 bags of plastic per foot of coastline in the world!

In India, more than 15,000 MTs of plastic waste are fashioned everyday, of which 6,000 MTs remain uncollected and littered. In a written response to a question in Lok Sabha, Minister of State for Environment, Forest and Climate Change Anil Dave said utilization pattern and consumer behaviour have changed and witnessed a manifold increase in PET bottles and plastic packaging of products. As per a report of a Task Force constituted by erstwhile planning commission in 2014, 62 million Ts of municipal solid waste were produced annually in urban areas, he said. However, as per the CPCB (Central Pollution Control Board) report in 2014-15, 51.4 million Ts of solid waste were produced in the country, of which 91% was collected, and 27% was treated and residual 73% disposed of at dump sites. Central Pollution Control Board has rough and ready the production of 15,342 million Ts of plastic waste in the country, out of which, 9,205 MTs were accounted to be recycled and leaving 6,137 million MTs uncollected and littered.[2]

3. Present scenario of India in Solid Waste Management: specially recycling or reuse of plastics

With growing population and rapid urbanization, waste generation in India has increased significantly over the last decade. Last year, the then environment minister Prakash Javadekar has revealed that 62 million tonnes of waste are generated each year in India[3] (**Figure 6**).



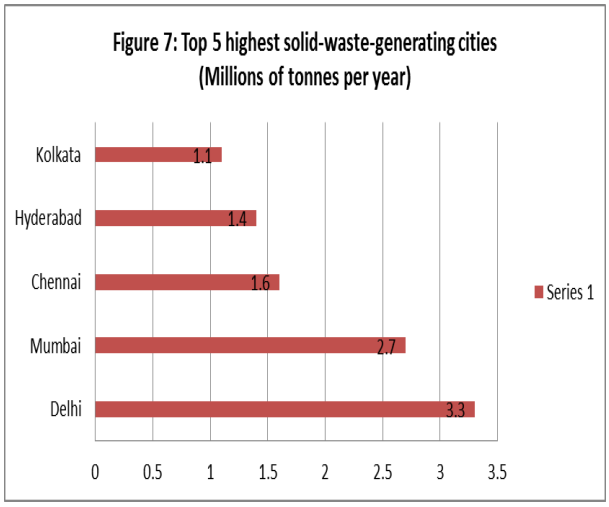
43 million tonnes of solid waste are serene annually, out of which 11.9 million (22-28%) are treated and 31 million (72-78%) are dumped at landfill sites. If garbage is deserted at the current rate without any treatment, 1,240 hectares of land will be required in the form of landfill area per year.

a) Landfills

More than 70% of collected urban waste is dumped at landfills. And most of them are brimming.

It has also been expected that annual waste generation will likely increase to 165 million tonnes by 2030. This means that 66,000 hectares of land will be necessary to set up a landfill site that is 10 metres high and can hold 20 years' worth of waste. To put things in perspective, that is almost 90% of Bengaluru's area. If the current waste management scenario does not improve, we will soon be buried in our own muck.

The rise in municipal solid waste generation is raising serious health and sanitation issues, including breathing problems, high PM10 exposure, increased mucus production, bacterial infections, elevated cardiovascular risk[3], asthma and other infections. Diseases such as dengue and cholera have been on the rise as vectors like insects and rodents are attracted to the waste. Improper waste management also adversely affects the environment. The decomposition of organic wastes at landfill sites produces greenhouse gases, while organic waste contaminates the water and soil. Clearly, inefficient waste management is a serious issue that needs to be addressed in India. Scientific disposal is imperative to abate the harmful effects of municipal solid waste. Also, local government authorities are responsible for building the infrastructure required to collect, segregate and transport and process solid waste effectively (**Figure 7**).



b) Recycling or reuse of plastic processes after segregation from solid waste dumping ground

Plastic which cannot be recycled, is generally incinerated in specially designed furnaces, together with other waste. Instead of burning it, plastic can be converted to fuel oils by a process known as pyrolysis, and a number of systems are available on the market for achieving this. Sizes range from 100 kg/day capacity to large units of 10 000 t/annum.

Conversion potential: The benchmark for conversion is 1 l of fuel for every kg of plastic input. Most systems work way below this benchmark but some achieve close to 85% of this target.[9] A typical example would be the plastic tops of PET bottles. These are made of high density polyethylene (HDPE), and cannot be recycled with the PET material, and are usually discarded by the plastic collectors. The bottle cap contains 30% of the total material in the bottle.

c) ***Feedstock recycling and pyrolysis:*** Feedstock recycling is a process that attempts to recover the original feedstock used to manufacture the recycled product, rather than converting the product into another form. Feedstock recycling is a form of tertiary recycling and encompasses a number of thermal or chemical processes that recover fuels or raw chemicals from plastic waste. Depolymerisation is a process that yields resins with the same quality as new feedstock, and is used to convert "clean" plastic waste. Pyrolysis is a thermochemical conversion technology that can be considered a "feedstock recycling" process and may play an increasing role in integrated waste management systems of the future. The advantage of pyrolysis is that it can have room for relatively contaminated feedstocks and value added materials can, if desired, be recovered prior to conversion to fuels, such as metals or hydrochloric acid.

Pyrolysis: Pyrolysis is a recycling technique which converts plastic waste into fuels, monomers, or other valuable materials by thermal and catalytic cracking processes. It allows the handling of mixed, unwashed plastic waste. For many years research has been carried out on thermally converting waste plastic into useful hydrocarbons liquids such as crude oil and diesel fuel. Recently, the technology has established to the point where commercial plants are now available. Pyrolysis recycling of mixed waste plastics into generator and transportation fuels is seen as the answer for recovering value from unwashed, mixed plastics and achieving their desired diversion from landfill. Generally speaking, the intensity of pre-treatment required of the feedstock lies somewhere between that for mechanical recycling (intensive) and incineration (non-intensive). It should be noted that the liquid energy-carrying medium that it produces is easy to store and so can be used on demand, and has a higher economic value than, for example, electricity produced via energy recovery from waste. Furthermore, pyrolysis can be employed alongside mechanical recycling and incineration in a cascaded waste management infrastructure so should be viewed as a component of a waste management system rather than a competing technology.[10]

HDPE, LDPE, PP and PS are all hydrocarbons consisting completely of carbon and hydrogen, which are similar to hydrocarbon fuels such as liquefied petroleum gas (LPG), petrol and diesel. Plastics are derived from petroleum and have calorific values in a similar range as those of LPG, petrol and diesel.

Not all plastics are suitable for pyrolytic conversion. The main branch of convertible plastics are known as polyolefins and comprise the following:

- High density polyethylene (HDPE)
- Low density polyethylene (LDPE)
- Polystyrene
- Polypropylene (PP)

PET and PVC are not considered suitable for this process because of low yields and acid production. PET is normally mechanically recycled and is seen as a valuable feedstock for other processes. In 2015 some 170 000 t of polyolefin was handled by the recycling business in South Africa. This represents a potential 150 000 l of diesel fuel.

So, for running a pyrolysis plant we can only use only High density polyethylene (HDPE), Low density polyethylene (LDPE), Polystyrene, Polypropylene (PP) after segregation from solid waste dumping ground. But PET and PVC are not considered suitable for this process because of low yields and acid production. So, segregation according to the composition of plastics from the municipal solid wastes is nearly impossible.[11]

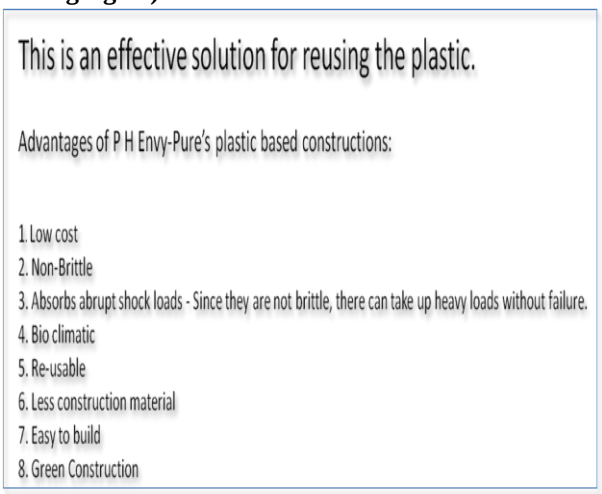
4. Present scenario on conventional constructions

In today's world, population is increasing day by day. As per a report population growth from the year 2005 to 2030 is estimated to grow from 1.1 billion to 1.47 billion. With the increase in population the demand of construction industry as well as construction materials is also increasing day by day. As per a report by dgm events India, the size of construction industry in India in financial year 2013 was about US$ 153 billion, which increased to US$ 157 billion in financial year 2014. As per a market research report 2014 by PWC it is estimated that the construction industry in India is likely to grow by a rate of 7% to 8%every year for next 10 years. Another study from the year 2005 to 2030, building construction industry in India is likely to grow by a rate of 6.6% per year. As the construction and development rate is increasing day by day, it is predicted that 70% of the wild life and natural habitat will be ruined by the year 2032. Out of the total energy used and emission of greenhouse gases, almost one third is contributed by building only6. As per a report, growth of GHG emissions in India from the year 2005 to 2030 is likely to

grow roughly 1.5 billion tonnes carbon dioxide equivalent to about 6.5 billion tones7. Carbon dioxide is one of the most important pollutants originated through human activities. As per a report, carbon dioxide contributed to almost 77% of the total greenhouse gas emission in the year 2004. China is one of the major carbon dioxide emitter in the world since 2013. In 2013 worlds total carbon emission was about 754.2 billion, in which chine contributed to about 14.4%. Among the total energy consumed in china 16% is consumed by building materials. It is assumed that, by the year 2050, building industry will contribute to about 52% of the total global carbon emission. Bricks are one of the widely used construction materials in India. Most of the brick manufacturing units are run by small scale entrepreneurs may be in small industries, villages or event in cottages3. Indian brick industry is second largest producers of clay fired bricks, producing more than 10% of global production. The brick manufacturing process in India is less energy efficient and generates a large amount of carbon dioxide to the atmosphere as coal is the main ingredient for firing bricks. On one hand the brick kiln establishment provides employment and adds to the prosperity of the village and on the other hand it also degrades the soil characteristics forcing the farmers to change their land use from agriculture to non-agriculture. As per a study of solid clay bricks fired in clamps, the carbon footprints were estimated as 162g CO_2/kg, due to combustion of fuel (bagasse) and transportation of raw material. Manufacturing process of bricks not only adds to the environmental pollution but also it offers high health hazards for brick kiln workers. As per a study on brick kiln workers of Punjab province (Pakistan) it was found that, the people working in brick kilns are exposed to high level carcinogenic risk due to exposure to dust bound PAHs.

For the overall growth of the economy of mankind a suitable waste management system is very necessary. In this study an effort has been made to review the various parameters of PET bottles to be consumed as a replacement of Traditional Bricks.[7]

5. Our Solution for all types of solid waste plastics is to go for the green constructions (nothing to be segregate)



Benefits of constructions with plastics

a. Reduces wastes and Environment Pollution Control
b. Locally Sourced & Economic Development
c. Preserves Natural Resources
d. Lowers Carbon Footprints
e. Inexpensive
f. Low Tech, easy to use
g. Highly compressive strength
h. Structural stability
i. Thermal stability
j. Sound insulation
k. Nill Light transmission
l. Eco-friendly decorative items
m. Children & Animal protective
n. Energy Efficient

a. Reduces wastes and Environment Pollution Control

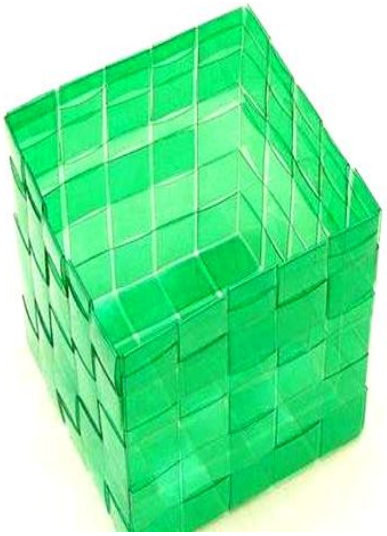
When we want to construct a clay brick, the time and energy use right from mixing the clay to baking it in the kiln and taking into explanation the firewood used for that. But the plastic made construction is far more energy-efficient. The technology also will reduce the carbon emission that come about during the baking of an

ordinary brick. The heat generation from cement factories can also be reduced as this expertise uses only five percent cement. The foundation for the whole construction was obtained from building waste and so the mountains from which granite was blasted out can be saved too.

b. Locally Sourced & Economic Development

Using recycled materials such as bottles, polythene bags to create building projects is a great way to reduce costs on a build, educate the local community about recycling and also benefits the environment.

By connecting the project with the local community and working with them to collect plastic bottles and waste plastic material from the project site. We want to work together to create a sustainable building from recycled materials.



c. Preserves Natural Resources & Lowers Carbon Footprints

A number of people have asked about the insinuations of using plastic bags on the personal carbon footprint as well as on the environment in wide-ranging. There are some contrasts between paper bags and plastic bags available which clearly show that it all depends on how many times these plastic or paper bags are being used.

Littering is probably the severest problem related to plastic bags. However let's now have a look at the carbon dioxide (CO_2) emissions for the produce and ignition of plastic bags.

The carbon footprint of various types of plastics (LDPE, PET and polyethylene) is about 6 kg CO_2 per kg of plastic. We was calculated the carbon dioxide emit level in our locality by using the weight of our used plastic bags.

- For the creation of 1 kg of polyethylene (PET or LDPE), requires the alike of 2 kg of oil for energy and raw material. Polyethylene PE is the most usually used plastic for plastic bags.
- Burning 1 kg of oil produces about 3 kg of carbon dioxide. In other words per kg of plastic, about 6 kg carbon dioxide is produced during production and burning.
- A plastic bag has a weight in the range of about 8 g to 60 g depending on size and thickness. For the further estimate, it now depends on which weight for a plastic bag we in fact using. A common plastic carrying bag in our household had a weight between 25 g and 40 g. So we took the average of 32.5 g.
- Take the above next of kin between kg plastics and kg of carbon dioxide. We got 200 g of carbon dioxide for 32.5 g of plastic, which is the equivalent of the average plastic carrying bag in our household. Or in other words: For 5 plastic bags we got 1 kg of CO2. [The main factors are the weight of the plastic bag and whether the grey energy is taken into account.]

d. Inexpensive

The cost of Plastic made green constructions will always be less than traditional brick house/ other construction materials. As the plastics to be used for construction are available in abundance and are free of cost. On the other hand a single traditional brick will cost nearly Rs.8.00/-. Rest of the building materials used in the construction of both the traditional house and green house are nearly same and will have a very less effect on the cost difference.

e. Highly compressive strength

In a study in 2014, the PET bottles of size 500ml were used and tested for their compressive strength in a Denisone Compressive testing machine. The bottles were filled with household plastic waste to make them eco-bricks. As per the study, weights of all the samples of eco-bricks were in a range of 245g to 260g. The

compressive strength results were also found good showing a resistance to compressive force up to 40KN.

As per another study in 2014, the plastic bottles were filled with soil and were tested for compressive strength. The results indicated that the average compressive strength resisted by various samples was 8.99MPa.

As per a study in 2016, the bottles were filled with fly ash and sand in various ratios and were tested for compressive strength. Best results were obtained by bottle sample filled with fly ash and sand in a ratio 2:1 resisting a compressive strength of 22,000kg.

As per an another study in 2016, a set of plastic bottles 105mm and 75 mm in diameter were collected and cut into 3 different heights of 200mm, 100mm and 50mm. the bottles were then perforated with holes of 10mm diameter on a distance 20mm centre to centre around the circumference. The plastic bottles so formed were wrapped with jute geo-textile from inside and filled with fly ash and some with aggregate of varying proportions. All the samples were tested for compressive load. The results indicated that the samples can resist a high compressive pressure up to 4000 KPa to 5000 KPa.

f. Structural stability

A study was conducted on a wall of 3m height and 300mm thickness. The wall was constructed with air filled bottles and tested for structural stability. The results indicated that the wall resists almost 50% less load as compared to individual block, may be due to mortar interlocking.

g. Thermal stability

A study was conducted on a small prototype green house built by using sand filled plastic bottles as bricks. The study indicated that indoor and outdoor temperature difference when compared with plastic bottle green house and a normal brick house remains more or less same. Both the houses have not achieved thermal comfort zone as the temperature ranges 30°C to 34°C for green house and 29°C to 34°C for normal brick house.

h. Sound insulation

As per a study the sound insulation parameters of Eco-bricks were investigated. The calculation of sound index is not possible unless an entire room of eco bricks is prepared. The study was conducted to calculate sound reduction index. A comparison of eco-bricks, concrete blocks and sand bricks was done. Results indicated that the eco-bricks have lowest sound resistance index as compared to sand bricks and concrete blocks.

i. Nill Light transmission

As per an investigation carried out on eco bricks it was observed that very low amount of light passes from the brick which is not even visible to human eye.

j. Eco-friendly decorative items

Instead of recycling these bottles, we can use these plastic wastes to make creative crafts such as decorative lights, dolls, decorative flowers, animals, bags, furniture etc.

k. Children & Animal protective

Many researches show that polycarbonate plastic, a type of plastic used in many household and food products, gradually leaches a chemical called bisphenol-A (BPA) into foods and liquids that are stored in containers made from this substance. The chemical compounds liberated by these plastics can alter hormones and have other potential human health effects.

Animals, including more than 180 species of which have been manuscript to ingest plastic debris, are also affected by the chemicals and can be permanently injured or die as a result of the poison.

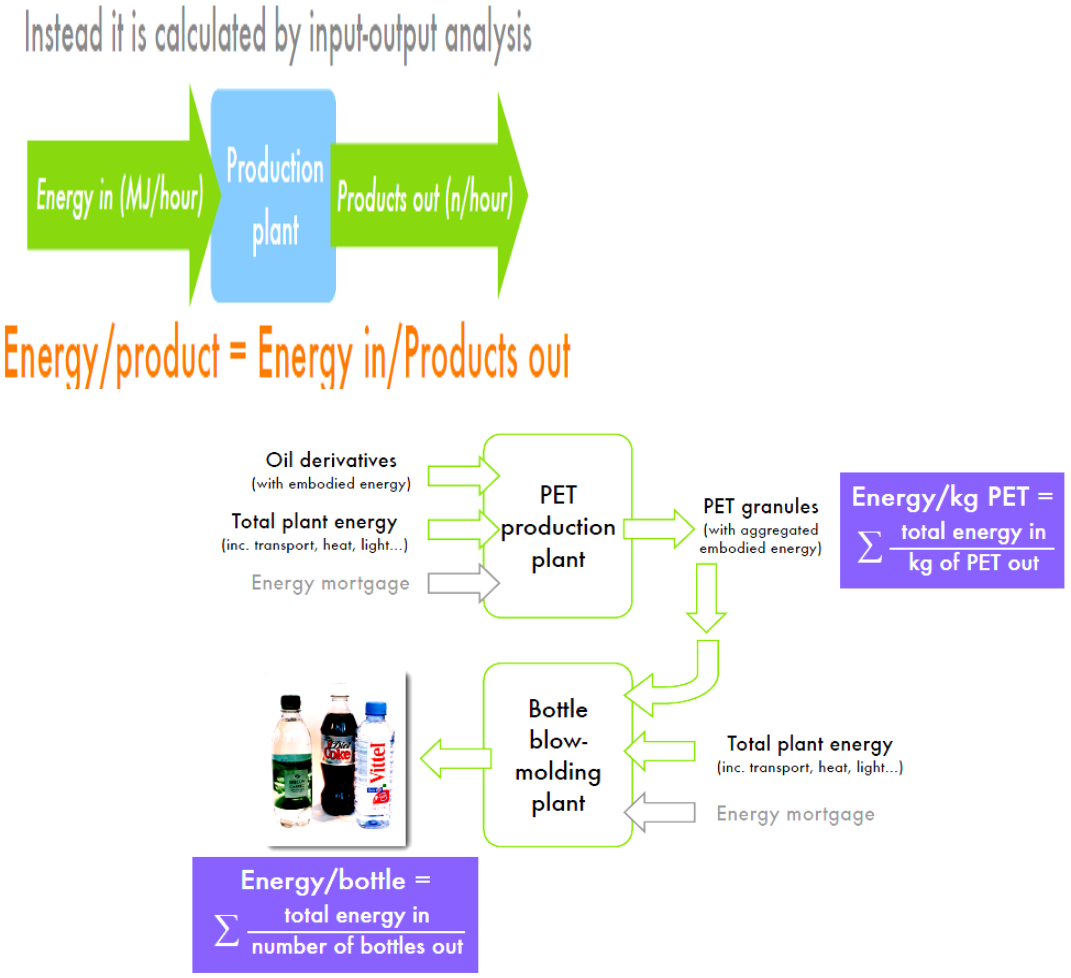
When these bottles are recycled, they are then used to make playground equipment, automobile parts, carpeting, clothing, sleeping bags, shoes, luggage and other plastic containers and many more which are not coming in direct contact of children and animals.

l. Energy Efficient

- Processing energy is relatively high.
- More fossil fuel energy is used in their production than for both Polyethylene and PET.
- So renewable plastics are not necessarily as environmentally friendly as they first appear.

The energy input during manufacturing is not calculated via thermodynamics because:

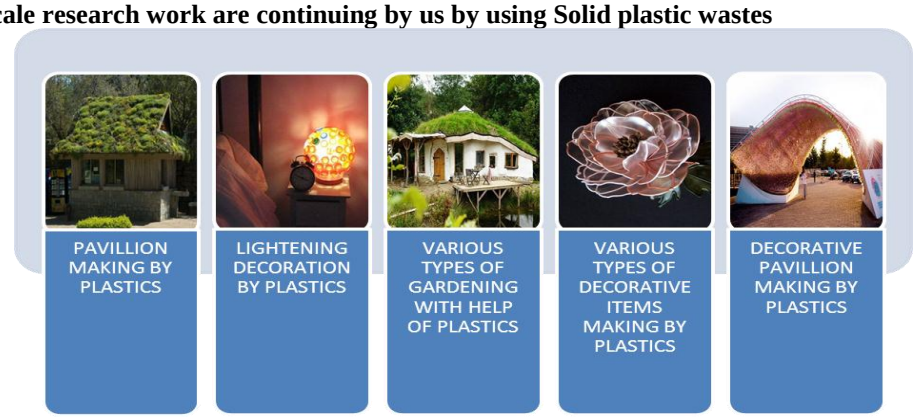
- Industrial procedures have varying efficiencies ranging from a few % to about 50%.
- The scrap-fraction assortments from a few % to 80% or more.
- Some fraction of the energy to heat, light and maintain the plant must be included.
- In any new venture there is an energy " mortgage" to be paid – the energy it cost to construct the plant



- Plastics are not unavoidably the waste and energy perpetrators that some people think they are. Plastics can be very energy efficient if it will reuse.
- It takes less energy to manufacture a plastic bottle than a glass bottle. And since plastics are lightweight, it takes less energy to transport a truckload of plastic bottles than a truckload of glass bottles.
- Up to 40% less fuel is used to transport plastic bottles compared to bricks.

6. RESEARCH AND DEVELOPMENT PROJECTS

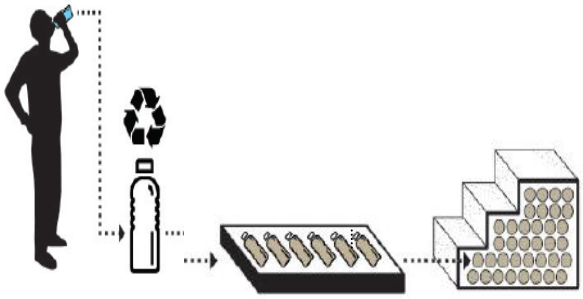
Various Pilot scale research work are continuing by us by using Solid plastic wastes



a. Pavilion Construction

Various types of pavilion was made by plastics/ pet bottles in pilot scale, like house building, office building, control room, community building, school, kiosk, clubs, fresh veg. & fruit shops, grocery shop, bus stand, floating island, floating garden, boundary wall, green house, car parking area, water storage tank, toiletry etc. By collecting plastic bottles and plastic waste to be used as a wall of construction and it improves the surrounding

environment and provides inexpensive building materials.



b. Roofing with plastics

Plastic bottles along with other recycled materials are often using for various types of decorated roofing. It will help for waterproofing roof. More research is going into providing solid waste materials solutions in environment disaster contexts (flood, storm etc.).

c. Plastics For Lightening

Plastic bottles along with other recycled plastic materials are often using for various types of decorated lighting. It will help for decorating. More research is going into providing solid waste materials solutions in low cost electricity(solar lightening bulb etc.).

d. Various types of gardening and garden decor items

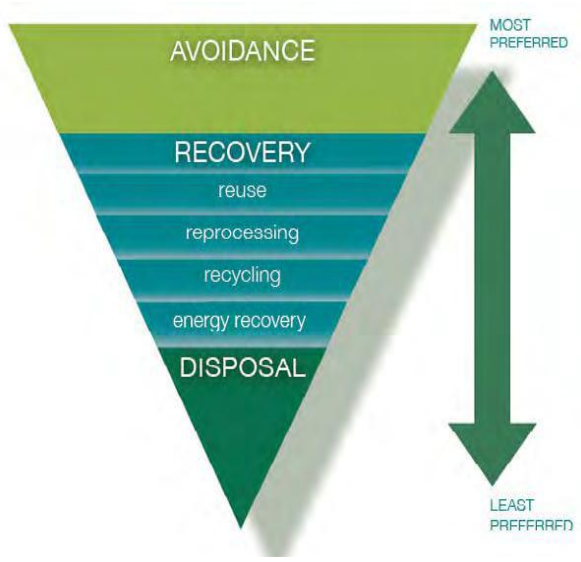
A project research work already going on various types of gardening, organic farming with the help of Plastics.

e. Making various types of decorative items

Various types of decorative items made from waste plastics. Decorative items can also help for an economic growth of a society by selling and manufacturing these items.

7. CONCLUSIONS

No curative time is required if waste PET bottles/Plastics are used as building material as contrasted to bricks which require 28 days curing time. Also while baking of bricks there is a most important issue of carbon emission which is insignificant in using PET bottles/plastics. PET bottles normally have a durability of over 300 years which is more as compared to standard bricks. Cost of edifice in case of brick bottle is more economical than standard bricks. Weight of a unit bottle brick was establish to be less than that of a standard brick. Compressive strength of the bottle brick is also almost equal than that of a standard brick. Thus we can conclude that by means of the concept of brick bottles is cost effective, energy efficient and commercially feasible. Using plastic is also Bio-climatic and thus we can say it is a Green construction. We often rationalize our decision to buy a product like bottled water by telling ourselves that the packaging can be reuse. Reusing makes us feel good and while reusing is more desirable than sending plastic to landfill, it is important to consider the environmental impact of transporting our reusable long distances and the energy and resources required for processing. The best alternative is to avoid buying single-use plastics like water in a bottle by carrying your own reusable bottle.



Reuse waste is more important than recycling and is at the peak of the waste management hierarchy. Many of our landfills are reaching full ability or closing, and all components of our environment, air, water, as well as open spaces are increasingly intimidated. Actually, with minimal effort, we can all help to solve our current solid waste disposal problems. Start by reusing waste as much as possible. Each time you reuse a product, a new one does not have to be manufactured and ultimately disposed of.

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