

Eco-Architecture: Pet Bottle Houses

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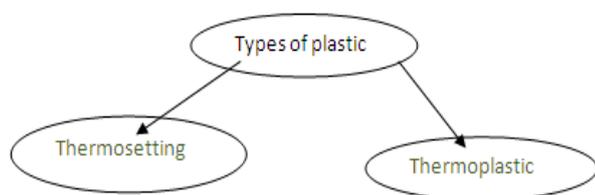
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Abstract: Eco -friendly architectural principles are being incorporated into more buildings every day in the world but they are still out of reach of many people due to lack of knowledge and awareness. Nevertheless, many traditional societies learned to build collaborating with nature, basing their buildings on an intuitive knowledge of the environment and climate, constructing buildings at a very low cost. In this research we implemented strategies and systems based on Eco-friendly environment and more advanced technologies but that could still be built at very low costs, with waste materials, providing adequate thermal comfort while being sustainable. A significant reduction in performance would be acceptable if the cost reduction is significant.

Introduction : This research explores the development and integration of low-cost technologies in a very low cost housing in INDIA. Plastic have become an indispensable part of our every day life since there introduction over hundred years ago. Their versatility in application also bring associated disposability problem.¹ Being a non- biodegradable substances composed of toxic chemicals, plastic pollutes earth air and water. Plastic causes serious damage to environment both during production and disposal. Plastic defies any kind of attempt at dispose it through recycling, burning, or landfilling. The only way to reduce the hazards of plastic is :

- 1- Reduction in production
- 2- Reuse of plastic(for purposes other than food)



PET PLASTIC

Full name: Polyethylene terephthalate

Molecular Formula: C₁₀H₈O₄

Structure:

Composition: Polyester of terephthalic acid and ethylene glycol.^{2,3}

Properties:

1. White or light cream material
2. Density 1.33220 gm/cm³

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3. M.P.-255 to 265⁰C

4. Solubility- Insoluble in water

5. It is heat resistant and chemically stable. PET is resistant to acid, base, some solvents, oils, fats. Difficult to melt and transparent.

Uses:

1. PET is used for high impact resistant container.
2. Used for packaging of soda, edible oils and peanutbutter.
3. Used for cereal box liners.
4. Microwave food trays.
5. Used in medicine for plastic vessels and for implantation.

History- Research and development related to the use of PET(polyesterterephthalate) for commercial plastic bottle application began in the late 1960 and intensified during the period 1971-1975.Two companies of US Continental Can Co.(CCC) and Owens-Illions,Inc.(O-I),established substantial R&D efforts at developing PET bottle technologies and both companies led the commercialization of this technology for carbonated soft drink application in the period from 1975-1982.

One of the best features about plastic is that it can be virtually indestructible. This makes it ideal to use for products such as milk bottles, beverages and drinking cups. However, this same quality makes disposing of plastic a major environmental headache.

Consumption- The global consumption of bottled water reached 154 billion litre in 2004,up 57% from 98 billion it consumed 5years earlier. Even in areas where tap water is safe to drink demand for bottled water is increasing, producing, unnecessary garbage and consuming vast quantites of energy. Bottled water is not healthier than tap water and its costs up to 10,000times more.⁴ Consumers associate bottled water with healthy living. Approximately 40% bottled water began as tap water, only difference is added minerals that have no marked health benefits.

PET plastic is preferred for disposable water bottles as it is durable and shatter proof.⁵

Although PET plastic as food contact material has been approved by US food and drug administration but repeated use of water bottle made from PET has shown to increase harmful bacteria levels.

Problem of Reuse- Bacteria from user's hand and mouth accumulate when the bottle is not washed between uses. Repeated hot water washing and handling of PET water bottles may breakdown the plastic, leaching toxic compounds such as DEHA in to beverages.^{6,7}

Bisphenol A used in many plastic containers such as reusable plastic bottles sold in sports good stores as well in baby bottles, US Food and Drug Administration and National toxicology program have expressed substantial concerns about the effects of BPA on the endocrine cardiovascular systems, infants and children are at particular risk.^{8,9}

Migration data: 19 migrants harmful for health from commercial PET bottle wall has been identified by GC/MS analysis. Fatty acids and commonly used plasticizers have also been identified.¹⁰

PET contains detectable amount of acetaldehyde which is able to migrate from polymer in to liquid media with help of headspace GC method, acetaldehyde was found in carbonated mineral water and lemonade. Acetaldehyde concentration range between 11 and 7.5 mg/l while the contents of acetaldehyde in the PET packages ranged from 1.1-3.8 µg/g.¹¹

Consumer who reuse plastic water bottle are unaware of potential health risk associated with high bacterial levels found on the bottle and leaching of plastic compounds in to the beverages.

Plastic in Recycling- Recycling represents a potential means of reducing the negative environmental impact of plastic disposal.¹² However, presently, only a very small percentage of plastic is actually recycled. Approximately 15 to 27 percent of polyethylene terephthalate (PET) plastic is recycled annually. PET plastics are primarily used for soft-drink bottles. High-density polyethylene (HDPE) plastic is commonly used for shampoo bottles, milk jugs and other types of so-called rigid plastic containers. Approximately 10 percent of HDPE plastic is recycled annually.

Lack of awareness regarding the quality of recycled plastic leads to its categorization as ecofriendly which is a great myth.

Problem of recycled plastic-

1. Major chemicals that are used in making plastic are highly toxic and are a serious threat to living of all species on earth, therefore recycle of a hazard put back toxic waste in the market place and eventually in to the environment.
2. Recycling of plastic is uneconomical, dirty and labour intensive as per study conducted by public interest research group based in Delhi, India.
3. Plastic recycling causes skin and respiratory problem resulting from exposure to inhalation of toxic fumes due to hydrocarbons and residues released during process.
4. Recycled plastic degrades in quality and necessitates the production of more new plastic to make original product.

Since the problem associated with plastic disposal has taken a giant shape and continued reuse of plastic and recycling does not provide ideal solution due to health risk and other associated problem discussed above, the present project is an attempt to provide solution to the never ending global plastic disposal problem by making shelter out of the PET plastic bottles which **are easily available and have properties of thermal and electrical insulator substances. These houses** present low cost, ecofriendly housing to poor and needy people and are equally strong as brick houses. They are an effective solution for the reduction of PET plastic from the environment and will solve the various problem related with the disposal of plastic.

Problem with Plastic Disposal-

The major problem with disposing of plastic is that it is non-biodegradable. This is one reason plastic is so durable. However, it differs in this respect from paper and organic substances. Instead, plastic photodegrades, which means that the sun breaks plastic down into smaller pieces of plastic, rather than down to the basic elements which make up the plastic.

Plastic in Landfills

Plastic accounts for approximately 25 percent of all refuse in landfills. This fact alone makes the disposal of plastic a major problem. Combined with the fact that plastic is non-biodegradable, this makes the presence of plastic in landfills a critical issue

Plastic in Incinerators

Incineration is generally an environmentally unfriendly means of plastic disposal. It results in polluting agents being released into the atmosphere, often without any filtering or treatment of any kind. A similar process called pyrolysis, designed to make plastic reusable in oil and chemical refineries, bakes plastics into a sort of hydrocarbon soup. Both processes are more expensive than recycling.

Plastic in Waterways

Much plastic waste is improperly disposed. A large percentage of improperly disposed plastic winds up floating in the ocean. For example, in 2003, a collection of plastic debris approximately the size of the state of Texas was discovered to be floating in the North Pacific. Plastic debris in waterways is often torn by photodegradation into small pieces which are eaten by marine animals, some of which wind up in the human die.

Since plastic is non biodegradable, toxic, highly resistant to heat and electricity (best insulator) and not recyclable in true sense, plastic pet bottles use in bottle brick technique will provide the following benefits :

- Waste management
- Environmental protection
- Cost effective
- Job creation
- Shock resistant
- Long lasting
- Reduced carbon emission
- Energy Efficient

B Methodology:

Bottle Brick Technology

- Capped Pet bottles will be collected from Garbage.
- The bottle will then be tightly packed with sand or mud and capped.
- These sand filled or mud filled bottle will work like brick. According to the size of hut,pet bottles will be required.
- Foundation will be laid down with bottle bricks and cement(concrete).
- Windows and door will be framed of wood or iron.
- Position of beams for holding roof and roofing with cemented sheet/tin sheet, for completion will be laid.
- At the time of roofing solar bomb (bottle filled with bleaching powder solution)will be fitted on the roof for light source.
- Leveling of the floor with brick bottles will be done.
- Inner and outer wall will be plastered.
- After that the house will be painted and ready to live.

Types of plastic bottle	No of box	No of bottle/box	Total no of bottle/month	No of bottle/year
Cold drink bottle(2 lit)	34 box	12	408	4080
Mineral water bottle(1 lit)	40 box	12	480	4800
Cold drink bottle(1lit)	40 box	12	480	4800
Mazza (1lit)	30box	12	360	3600
Mazza(600ml)	40 box	24	960	9600
Cold drink bottle(500ml)	40 box	24	960	9600
Total	224	96	3648	36480

Source data for waste pet plastic bottle at M U/Month:



Advantages of Bottle Brick Construction:

Bottle brick construction will provide excellent solution for shelter in poverty stricken country.

It will prove to be the best use for refused pet plastic bottle. Construction based on bottle brick technology will be 20 times stronger than brick construction. efficient solution to worldwide problem of plastic bottle garbage.

CONCLUSION

It is expected that by utilizing pet bottles in construction recycled materials, thermal comfort can be achieved in very low cost housing, benefiting residents that can not afford to buy and operate heating and cooling systems. The results of this research should be disseminated to residents in the area, so that the tenants can implement the changes themselves without having to hire builders or specialists in order to have a home that provides more thermal comfort and is more sustainable. This give relief for the poor people of India to provide cheap and best houses for living.

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