

Reuse & Recycle of Non-Biodegradable Waste As Construction Materials

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Abstract: *The objectives of writing this paper are to study the current practices related to the reuse and recycling of non-biodegradable waste as a construction materials, to reduce the amount of non-biodegradable waste going into landfills; and also to reduce the consumption of raw materials by the construction industries. Which have an environmental issue at every step and also increases the construction cost which leads no home for poor as well. This paper also includes the already used technique of non-biodegradable waste as a construction which will help to find the scope for improvement to make world "GO GREEN."*

Keywords: Non-Biodegradable, Construction, Environment, Cost Effective, Recycle/Reuse

Introduction:-

There are few things certain in life- one is death, second is change and the other is waste. No one can stop these things to occur in our lives. But with better use of techniques we may prepare ourselves. Construction and Demolition(C&D) waste produced are in large quantities, and left in the landfills at the city outskirts. Reuse and recycle of Construction waste materials attracts new technology, social values, costs and employment. "Recycling is a process of reuse of used material into new, useful product". It also helps to reduce the dependency on virgin material and importation of foreign materials, reduces use of energy and a nice technique of controlling air, water and land pollution. The technique of recycling waste into new useful product is a great and sustainable approach or we can say it's a great step to make world "GO GREEN". Going green has become a need of the hour, to design and construct sustainable buildings are at the forefront of this green revolution.

Indian cities which are fast competing with global economics in their drive for fast economic development have so far failed to effectively manage the huge quantity of waste generated. There are about 593 districts and approximately 5000 towns in India. The current population of India is 1,343,490,466. Approximately 17.86% of the world's population and it ranks number 2 in the list of countries. About 32.8% of India's population of more than one billion lives in urban areas. India generates 150 million tons of waste in a day and only 10.20% of the city waste is recycled in an eco-friendly way and rest is left at the landfills in the city outskirts. The quantum of waste generated in Indian towns and cities is increasing day-by-day on account of its increasing population. The annual quantity of solid waste

generated in Indian cities has increased from six million tons in 1947 to 48 million tons in 1997 with an annual growth rate of 4.25% and it is estimated to reach 300 million tons by the year 2047.

Nowadays reusing waste materials from construction site and nearby site elements such as trees, structures, and paving is becoming a trend in the built environment, however more unorthodox materials such as soda cans, bottles and tires are being discovered as recyclable building materials.

Impact of Construction Material on Environment:-

The built environment consists of elements that provide space and accommodation for people and his various activities like education, recreation, manufacturing, vending of goods and services, among others. Apart from these, there are infrastructures which includes roads, power plants, telecommunications transmission facilities, and similar installations which are the products of construction industry. Traditionally, construction materials were originated with locally available materials which described the character of the historic built environment. Construction technologies led by small-scale craftsman were used to build Vernacular buildings which were not befitting for the high volume, mass-produced built environment. Financially efficient technologies were introduced with industrialization which helped in the production of bricks, concrete and steel. Such materials are low cost to produce and require low skill levels to convert into buildings. They all, however, share a common high energy cost in areas such as extraction, processing and transportation. In addition, these materials all come from finite resources. Once extracted and converted, the raw material is gone forever.



Figure 1- A simplistic perspective on the building supply chain

This is the major reason why construction wastes are commonly called as construction and demolition (C & D) wastes. The C&D wastes create disposal problems as land fill

sites are becoming scarce and also some hazardous materials may leach into the underlying soil layers.

Recycle and Reuse of Non-Bio-Degradable Waste:-

The concern about the future need and to minimize the negative environmental impact of building are pretty much known to everyone. The organic waste are easily degraded with time but when it comes to the materials that do not get decomposed easily and take millions of years to degrade; such waste are known as non-bio-degradable wastes. Reuse and recycling of non-bio-degradable wastes is a growing area of interest and concern in many parts of the India. Current practices and strategies in the waste management area are examined from a building life cycle standpoint or cradle to reincarnation concept it include zero waste, integrated recycling, international approaches, and reuse of materials, resource optimization, waste reduction, and deconstruction.

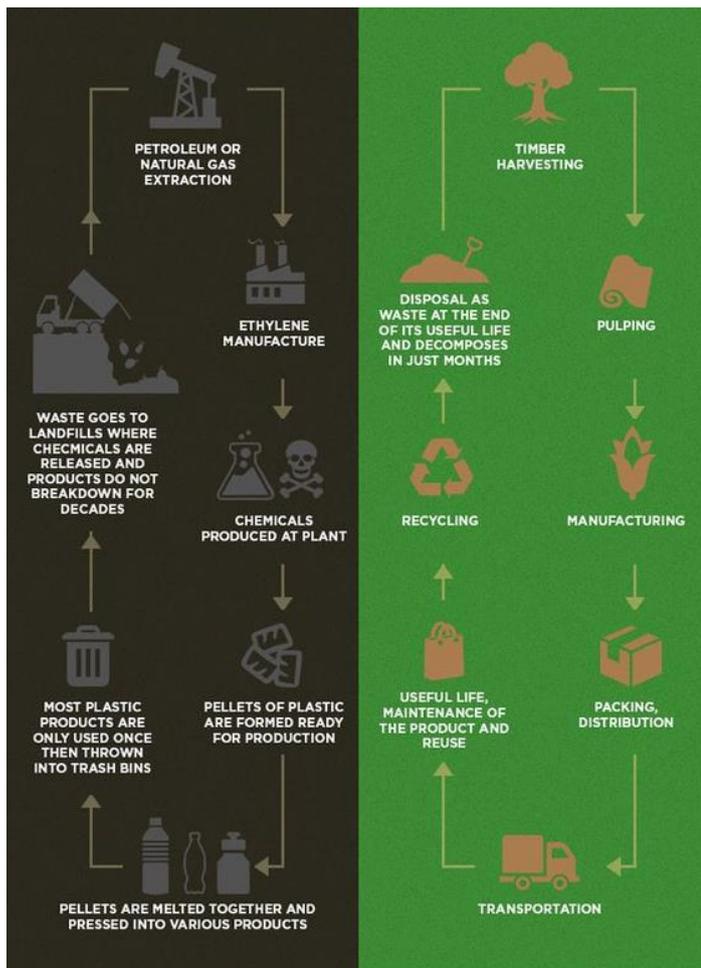


Figure 2- Plastic versus Biodegradable life-cycle

Non-biodegradable wastes are categorized on the basis of their toxicity. These wastes, when dumped in the land, may eventually contaminate and poison ground water and takes

decades to get decomposed. Which is a one of the main reason for affecting the environment.

The use of raw materials can be reduced through recycling and reuse of non-bio-degradable wastes. However, the consumption of materials always increases with the increase of the population. Even so, the only way to reduce the consumption of raw materials and to minimize the impact of non-bio-degradable waste to the environment is to economize the use of materials, recycling and reuse.

Statistics on Waste Generation in India:-

Reuse of discarded construction waste materials in India is not new, it is only they have not been properly documented for future use. Non-bio-degradable wastes can be processed or recycled to replace virgin materials for immediate needs. In India and most of other developing countries where technological development is still growing, some regions especially large urban areas already facing problems of obtaining adequate aggregate supplies at reasonable cost due to distance. A brief look at the census will help us get a gist of the problem of non-biodegradable waste being generated in India because waste generation is directly proportional to the amount of population.

Population:-

India is the second most populous nation on the planet. The Census of 2011 estimates a population of 1.21 billion which is 17.66% of the world population. It is as much as the combined population of USA, Bangladesh, Brazil, Indonesia, Pakistan, and Japan. India’s urban population was 285 million in 2001 and increased to 377 million in 2011. Indian urban population is greater than the total population of USA (308.7 million), the third most populous nation. Indian population increased by more than 181 million during 2001 – 2011, a 17.64% increase in population, since 2001.

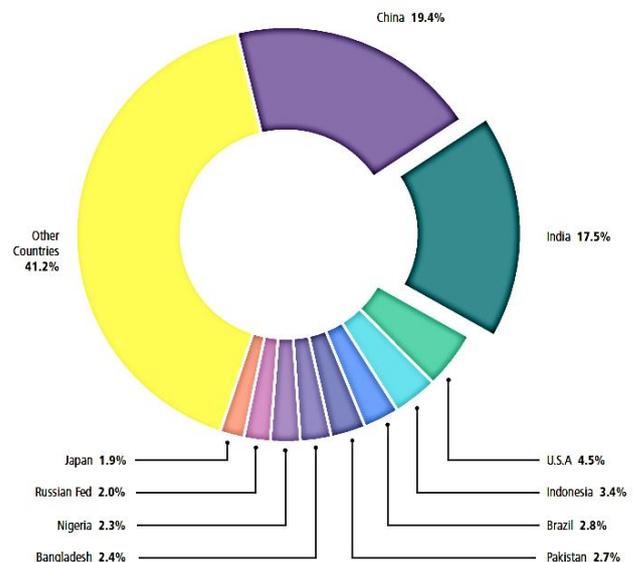


Figure 3- India in world population

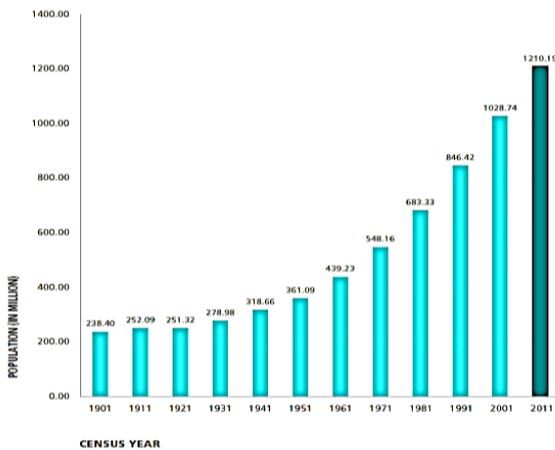


Figure 4- Population (in millions), India: 1901-2011

Waste Generated In India:-

India generates 150 million tons of waste in a day and only 10.20% of the city waste is recycled in an eco-friendly way and rest left in the landfills at the city outskirts. About 14.5 MT of solid wastes are generated annually from construction industries, which include wasted sand, gravel, bitumen, bricks, and masonry, concrete. However, some quantity of C&D waste is being recycled and utilised as building materials whose share could vary from 25% to 75% from old buildings to new buildings respectively.

Year	Population x10 ⁶	Per capita generation (kg per day)	Total waste generation (thousand tonnes/year)
2001	197.3	0.439	31.63
2011	260.1	0.498	47.30
2021	342.8	0.569	71.15
2031	451.8	0.649	107.01
2036	518.6	0.693	131.24
2041	595.4	0.741	160.96

Table 1- Population growth and overall impact on waste generation

Growth of population, increasing urbanisation, rising standards of living due to technological innovations have contributed to an increase both in the quantity and variety of solid wastes generated by industrial, mining, domestic and agricultural activities.

Analysis and Interpretation:-

Many NGOs and Government throughout the world are taking initiatives to recycle and reuse non-biodegradable waste for better useable products that could be used in construction. A comparative analysis was done on four projects constructed in India, utilizing non-biodegradable waste as resource product-

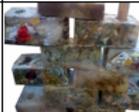
PARAMETER	STUDY 1	STUDY 2	STUDY 3	STUDY 4
				
Initiation	Converting Plastic Waste into Bricks	Constructing Roads from recycled plastic	Crushed Tiles reused to make fresh tiles	Construction of Bottle House
Material	Plastic bags, plastic cups, etc.	Plastic carry bags, plastic cups, plastic packaging etc.	Construction and Demolition (C&D) debris includes bricks, concrete, masonry, soil, rocks, lumber, paving materials, shingles, glass, plastics, rocks, aluminium etc.	Waste plastic bottles which filled with mud, fly ash or sand.
Construction technology	Bricks are connected together by interlocking technique - they have two holes which makes it possible to stack and connect them with bamboo poles to create stable walls without the need for cement or other building materials.	Plastic waste coated aggregate is mixed with hot bitumen and the resulting mix is used for road construction.	-	Plastic bottles is with mud and cement mortar slurry is poured on top which joins the bottles together to build sustainable and earthquake resistant homes at low cost.
Techniques	Recycle	Recycle	Reuse and recycle	Reuse
Energy efficient	Melting the plastic through solar energy that saves electricity		Washing process requires 10-12 tankers of treated effluent every day and even that water is reuse and recycle again	Converting the waste PET bottle into an eco-construction material
Strength	Plastic bricks can withstand up to six tons of pressure	The lifespan of a road is about three years. But road with bitumen-plastic mix, it is increased to about six years.	Used for non-load-bearing structure	Concrete being a strong binding agent, makes the building durable and strong

Table 2 – Non-biodegradable waste as resource product

Comparative analysis on four projects constructed in other countries, utilizing non-biodegradable waste as resource product-

PARAMETER	STUDY 1	STUDY 2	STUDY 3	STUDY 4
Image				
Initiation	Pet pavilion	Plastic bottle house turns into affordable housing	Recycled materials cottage	House was built by using recycled plastic bricks
Material	Steel, plastic bottle, corrugated sheets.	Waste plastic bottles which filled with mud, fly ash or sand, cement.	Construction and demolition (C&D) materials includes bricks, steel, door, soil, rocks, lumber, paving materials, shingles, glass, laminated beam, aluminium etc.	All types of plastic waste.
Construction technology	Structure consists of two monumental slabs in a steel framework. Plastic bottles attached with double-walled transparent corrugated sheets.	Plastic bottles is with mud and cement mortar slurry is poured on top which joins the bottles together.	-	Cement mortar slurry is poured on top which joins the bottles together to build sustainable and earthquake resistant homes at low cost
Techniques	Reuse	Reuse	Reuse	Recycle
Energy efficient	Instead of using raw materials, a temporary structure made with already used plastic which helps to save energy required for manufacturing of new materials.	Raw materials are saved as very less construction materials are required for its construction.		
Strength	-	Concrete being a strong binding agent, makes the building durable and strong.		These bricks are thermos acoustic and earthquake-resistance

Table 3 – Non-biodegradable waste as resource products

Comparative analysis of technique used in India with other countries:-



Figure 5- Comparison between India and other Countries

In contrast with other countries, India is more into recycling of non-biodegradable waste products. Other countries give more preference to reusing the waste than recycling. It is better to reuse waste than recycle as recycling utilises energy. This is where India loses point as energy consumption increases.

Also, since other countries are more productive and are developed, they build their buildings better aesthetic appeal even though it's made out of waste. Since India is dealing with poverty, it is therefore focusing more on affordability than aesthetics.

Conclusion:-

Rapid consumption of materials required mass production which have negative impacts on the environment. To reduce their impacts, recycle and reuse of non- biodegradable waste

as construction materials is a better way instead of using traditional materials. Reuse and recycling techniques can be used in an innovative way to protect the environment and save resources.

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