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Use of Imperishable Material like Plastic, Bottles and Fly Ash for Building Material to Minimize Global Warming

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ABSTRACT: The urbanization process contributes to the growth of solid waste generation and causes an increase in environmental impact and errors in solid waste management. The number of landfills is a concern due to the limited implementation and safe disposal of this waste. Interest in technical sustainability has increased in relation to waste management, which is largely being absorbed by the construction sector. mixes and patches. Linked to this is the use of life cycle analysis (LCA) as an instrument with which the sustainability of products and processes can be improved in the long term. After analysing the recent literature, it was found that studies on plastic waste in building materials focus sustainability on the alternative destination of waste. As plastic waste originates from different production chains, the need for more comprehensive diagnostics such as LCA could be reinforced, providing greater quantification of the data that make alternative processes and products more sustainable. The study contributes to improving the sustainability of alternative building materials through the life cycle assessment.

KEYWORDS: lifecycle; circular economy; PET; construction; sustainability

I. INTRODUCTION

Recently, on the one hand, people are always looking for broader sources with lower prices, and on the other hand, they are taking the path of getting rid of plastic waste. This paper presents the modernization and low-cost housing construction in India. The generation of plastic waste is one of the fastest on an industrial scale. The rate of expansion is estimated to double every year. This waste produced today will remain in the environment for hundreds and perhaps thousands of years. As landfill space is rapidly shrinking, the cost of solid waste disposal is escalating. A solution to this crisis is to recycle the waste into the useful process. Therefore, this plastic waste is used in the construction process. About 43 million tons of solid waste are produced annually in India. These increase annually by 1.5 to 2%. Plastic accounts for 30% of all waste produced, with most coming from discarded plastic bottles. Plastic waste cannot be disposed of through landfill or incineration because it causes forest fires or contaminates soil and vegetation. Compared to other materials such as metal, plastic bottles are less expensive, have a higher strength-to-weight ratio, are more durable, collapsible, easy to process and form, and have low density. However, plastic waste in general is a risk to the atmosphere.

When making a clay brick, the time and energy expended from mixing the clay to baking it in the kiln, and considering the firewood used, you will find that the bottle brick is much more energy efficient. The technology also reduces the carbon emissions produced by firing an ordinary brick. Heat generation from cement factories can also be reduced, as this technology uses only five percent of the cement. The basis of the entire construction is obtained from the rubble and thus the mountains from which the granite is mined can also be saved. The PET bottle can last up to 300 years (certainly longer than the cement used to glue the bottles to the walls!). The result of this high consumption is nothing other than reducing the initial resources and increasing the size of the landfill. Recently, people are always looking for broader sources with lower price on the one hand and pursuing the way of getting rid of waste on the other hand. Waste can now be produced anywhere there is a human footprint, reminding you that you didn't choose the right way to utilize it. nature today we have the possibility of using renewable resources such as solar, wind and geothermal heat more than ever and the development of this science is progressing. But among the renewable and alternative energies, instead of fossil fuels, one can choose those energies that are as cheap as possible and have less environmental energy impact.



Because the lack of attention to economic issues means that these energies are only used by groups that are dedicated to a specific segment of society. While many renewable energy projects are large-scale, renewable technologies are also suitable for rural and remote areas. The problem for users is that they are losing the power and ability to design and build their own homes themselves. Because building their houses are expensive building materials, and the labour and transportation can also be long.

II. LITERATURE REVIEW

Ahsan Rabbni on November 4, 2017 Experimental study on the use of fly ash in concrete. The use of fly ash in concrete as a partial replacement for cement is gaining importance every day. Technological improvements in the operation of thermal power plants and fly ash collection systems have improved the quality of the fly ash. Investigate the use of fly ash in concrete. Cement is partially replaced by fly ash in concrete. In this experimental work, concrete mixtures are prepared with 0%, 25%, 50%, 75% and 100% fly ash substitute. The effect of fly ash on workability, setting time, compressive strength and water content is investigated. In order to investigate the effects of the partial replacement of cement by fly ash on the concrete properties, tests were carried out with different concrete mixes. From the study it can be concluded that replacing cement with fly ash in low grade cements like M20 makes sense. Incorporating fly ash into concrete can save the disposal costs of the coal and heat industries and produce a more environmentally friendly concrete for construction.

D. Rajkumar October 7, 2020 Studying the use of plastic bottle waste in construction. The author concluded that plastic bottle waste is cheaper to mint than most conventional building materials such as sand and concrete or brick containing any number of plastic bottles, reducing the total amount of conventional material needed, which also reduces costs. The use of plastic bottles in construction helps protect the environment and save energy as buildings with plastic bottle walls maintain the ambient temperature and help save energy and the cost of deploying a system.

Pravin Gadling December 5, 2017 Comparative study of fly ash brick and regular clay brick. This document introduces the characteristics of the manufacturing process of fly ash bricks, the material required to manufacture the clay bricks and the fly ash bricks according to the Indian Quality Control Standard Code. The textures of the fly ash stones were similar to those of the mudstones; the sample with the additive contains spherical fly ash particles. These fly ash particles reduced the density of the brick and significantly improved its durability. The use of this additive could have practical implications as a means of recycling and achieving cost savings in brick production. The shape and magnitude of the absorption coefficient, density, weight, porosity, thermal conductivity and compressive strength of fly ash bricks are compared with ordinary clay bricks, which gave good results. From the present study it can be concluded that fly ash bricks are used as an alternative to clay bricks. The result of 40% fly ash with 60% will be a good combination. Fly ash bricks show less damage than conventional bricks when exposed to salt crystallization.

Mojtaba et al. concluded that the use of plastic bottles as building materials can have a significant impact on saving embodied energy in buildings by using them instead of bricks in the walls and reducing CO₂ emissions in cement production by reducing the percentage of cement used is reduced. Shilpi et al. They concluded that thermal comfort can be achieved in very inexpensive homes by using PET bottles in recycled building materials.

Puttaraj et al. It has been studied that the effective use of plastic waste in plastic building blocks has led to the effective use of plastic waste, and thus can solve the problem of safe disposal of plastic. It also avoids widespread landfill and the use of quarry waste has somewhat reduced the disposal problem.

Vikram Pakrashi et al. investigated Eco brick as a viable resource for construction purposes with several potential applications. It has been found that Eco brick weight is closely related to breaking load and specific strength. Eco bricks have a relatively good specific resistance. Andreas Froese et al. came to the conclusion that the plastic bottles filled with earth or sand act like bricks and form a frame for the walls. Different types of walls are built, varying in size and orientation of the bottles. PET bottle walls withstand up to 4.3 N/mm² when bottles are filled with sand or earth, the weakest filling material. In addition, the method has so far proven to be earthquake-proof and enables short construction times.

III. OBJECTIVE OF WORK

The primary objectives of this project can be summarized as follows:

- Replacement of conventional material with plastic bottles which are non-degradable in nature.
- Use in fly ash which is hazardous to environment and non-degradable.



- Cost of construction will minimize due to this waste material.
- This material is eco-friendly in nature if we use in construction.

IV. SCOPE OF WORK

- Reusing the plastic bottles as the building materials can have substantial effects on saving embodied energy by using them instead of brick in walls and reducing the CO2.
- By using this technology, these houses are ideal for hot climate because the bottle brick buffer the house from intense heat.
- The bottle which are required for the plastic bottles construction are mostly sourced from, restaurants, homes and near any tourist’s place.
- Fly Ash can’t decompose that’s why it is used.

Basic construction material and their properties:

This construction requires some of the basic materials which ensure a stable, eco-friendly structure and also results in cheap construction as compared to a brick wall.

Basic construction materials:

- 1) Soil 2) Plastic Bottle 3) Cement 4) Nylon Rope 5) Water

1) SOIL

Soil is the basic element in any construction project so before using it in our project we have to study the basic properties of the soil and go through different tests, to check whether the soil sample selected is suitable for the given project.

Properties Result	Properties Result
Specific Gravity 2.65	Specific Gravity 2.65
Optimum moisture content	Optimum moisture content
10.2 %	10.2 %

2) PLASTIC BOTTLE

In this paper, plastic bottles are used as a fundamental element, so we have gone through every property of the PETE bottles to ensure a stable structure.

Property Result	Property Result
Chemical Formula (C10H8O4)n	Chemical Formula (C10H8O4)n
Density 1.38g/cm3(20°C)	Density 1.38g/cm3(20°C)
Melting Point >250°C, 260°C	Melting Point >250°C, 260°C
Boiling Point >350C (decomposes)	Boiling Point >350C (decomposes)

3) CEMENT

Cement is an important binding material. In this paper is used to bind the plastic bottles to make the masonry wall more durable so that the quality of cement is check by following properties.

Property Result	Property Result
Consistency 35 %	Consistency 35 %
Initial setting time 30 Minutes	Initial setting time 30 Minutes
Final setting time 600 Minutes	Final setting time 600 Minutes
Fineness 8.16 %	Fineness 8.16 %
Specific Gravity 3.43	Specific Gravity 3.43

4) NYLON ROPE

Nylon rope has a very high tensile strength so that it is used as the main binder for PETE bottles masonry

Properties of Nylon rope:

Nylon rope is gotten from coal, Petroleum, air, and water, the properties of nylon as follow:



- 1) Good abrasion resistance.
- 2) Tough and strong but flexible too.
- 3) High impact strength.
- 4) Absorb water which causes a reduction in strength and impact properties

5) WATER

Water is similarly way to cement, an active component in mortar. The quality of water uses as a direct impact on the strength of the mortar and cement in the construction work. 20% of the overall weight of the cement and soil was used to determine the quantity of water to be used in the mix.

V. METHODOLOGY

This study applies the qualitative approach of content analysis to review the relevant literature exploiting the use of plastic waste bottles in construction. This allows the researcher to identify the feasibility of using plastic waste bottles in construction. As summarized by Mayring (2000), this type of research approach defines itself as a method of careful empirical and procedural analysis of texts contained within their communication framework, analytical rules of fluid content without hasty quantification. To put it simply, the objective of qualitative content analysis can be all types of documented communication that are not based on documents, interview protocols, speeches, observation protocols, etc. are limited. Similarly, Krippner (1969) adds that content analysis denotes the use of a reproducible and effective method to transform the text into other states or properties of its sources. Furthermore, qualitative content analysis involves methodically reading and extrapolating a set of texts and symbolic material, not necessarily from the author's or research's perspective.

Benefits of waste plastic in construction:

1. The total waste generated is reduced.
2. The source of building material is local. No additional cost for the same.
3. The natural resources are preserved.
4. The carbon footprint is reduced.
5. The plastic bottle is expensive.
6. The technology used is short and easy to execute.

VI. CONCLUSION

- Reusing the plastic bottles as the building materials can have substantial effects on saving embodied energy by using them instead of brick in walls and reducing the CO₂.
- By using this technology, these houses are ideal for hot climate because the bottle brick buffer the house from intense heat.
- The bottle which are required for the plastic bottles construction are mostly sourced from, restaurants, homes and near any tourist's place.
- Fly Ash can't decompose that's why it is used.

REFERENCES

1. Zhou, Z.; Tang, Y.; Dong, J.; Chi, Y.; Ni, M.; Li, N.; Zhang, Y. Environmental performance evolution of municipal solid waste management by life cycle assessment in Hangzhou, China. *J. Environ. Manag.* 2018, 227, 23–33.
2. Awoyera, P.O.; Adesina, A. Plastic wastes to construction products: Status, limitations and future perspective. *Case Stud. Constr. Mater.* 2020, 12, e00330.
3. Al-Fakih, A.; Azan, R.; Borisenko, Y.G.; Shvachev, D.; Vorobyev, D.; Amran, Y.H.M.; Alyousef, R.; Alabduljabbar, H. Bituminous mineral compositions for paving with cullet. *Case Stud. Constr. Mater.* 2020, 12, e00317.
4. Bacarji, E.; Filho, R.T.; Koenders, E.; Figueiredo, E.; Lopes, J. Sustainability perspective of marble and granite residues as concrete fillers. *Constr. Build. Mater.* 2013, 45, 1–10.
5. Pereira, T.G.T.; Silva, D.W.; Eugênio, T.M.C.; Scatolino, M.V.; Terra, I.C.D.C.; Fonseca, C.S.; Bufalino, L.; Mendes, R.F.; Mendes, L.M. Coconut fibers and quartzite wastes for fiber-cement production by extrusion. *Mater. Today Proc.* 2020, 31, S309–S314.
6. Singh, J.; Cooper, T. Towards a sustainable business model for plastic shopping bag management in Sweden. *Procedia CIRP* 2017, 61, 679–684.



7. Miteva, K.; Slavcho, A.; Bogoeva-Gaceva, G. Kinetic analysis of pyrolysis of waste polyolefin mixture. *Arab. J. Sci. Eng.* 2016, 41, 2601–2609.
8. Horodytska, O.; Kiritsis, D.; Fullana, A. Upcycling of printed plastic films: LCA analysis and effects on the circular economy. *J. Clean. Prod.* 2020, 268, 122138.
9. Spósito, F.A.; Higuti, R.T.; Tashima, M.M.; Akasaki, J.L.; Melges, J.L.P.; Assunção, C.C.; Bortoletto, M.; Silva, R.G.; Fioriti, C.F. Incorporation of PET wastes in rendering mortars based on Portland cement/hydrated lime. *J. Build. Eng.* 2020, 32, 101506.
10. Sharma, R.; Jain, P.; Sadhu, S.D. Study of morphological and mechanical properties of PBT/PTT blends and their nanocomposites and their correlation. *Arab. J. Sci. Eng.* 2019, 44, 1137–1150.
11. Perera, S.; Arulrajah, A.; Wong, Y.; Horpibulsuk, S.; Maghool, F. Utilizing recycled PET blends with demolition wastes as construction materials. *Constr. Build. Mater.* 2019, 221, 200–209.
12. Alfahdawi, I.H.; Osman, S.; Hamid, R.; Al-Hadithi, A.I. Influence of PET wastes on the environment and high strength concrete properties exposed to high temperatures. *Constr. Build. Mater.* 2019, 225, 358–370.



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