"Utilization of Waste Plastic in Manufacturing of Brick with Fly Ash"

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Abstract *- Population growth and economic development are contributing to a rise in plastic trash. Because plastics cannot biodegrade, disposing of waste plastic has become a significant issue on a worldwide scale. Annually approximate 500 billion plastic bags are used worldwide. Plastic in our seas kills over a million sea birds and 100,000 marine animals every year. To overcome these defects we can use the plastic in construction sector as a raw material in different ways.*

Plastic trash is a non-biodegradable waste that cannot disintegrate, which results in contamination of the air, water, and land. Additionally, when we burn plastic garbage at the dump, its proportion is rising quickly, which is a sign of the environment's destruction and the depletion of resources owing to the excessive use of clay. In order to innovate in this area as civil engineers, we are attempting to create plastic dust bricks in this case.

Key Words - Utilize plastic waste, manufacturing fly ash brick

1. INTRODUCTION

Bricks, concrete blocks, tiles, and other common building materials are utilized in construction. However, these materials are pricey, making it impossible for regular people to readily buy them. Additionally, these construction materials need certain compositions in order to have the appropriate qualities. One of the most recent engineering materials to enter the market globally is plastic. It is a malleable substance that can be molded into solid things and is made up of a variety of synthetic or semisynthetic organic chemicals. Plastics may, by definition, be heated into a variety of forms. It comes in a variety of shapes and sizes, including cups, furnishings, basins, plastic bags, and food and drink containers, and it eventually degrades into garbage. Such wastes can accumulate and have harmful impacts on both people and plant life.

As a result, there is a need for proper disposal and, if feasible, for using these wastes in their regenerated forms. Every day, more plastic garbage is produced throughout the world. Waste plastics are left lying about in areas without a suitable garbage collection system, which is a nuisance. Additionally, it harms the ecosystem.. A significant amount of trash plastic is thrown away or burnt, which contaminates the ecosystem and the atmosphere. A significant area for the reuse of waste materials is the substantial amount of materials needed to build infrastructure.

Recycling the plastics has advantages since it is widely used worldwide and has a long service life, which means that the waste is being removed from the waste stream for a long period. Reuse of waste plastics has environmental benefits not only related to the safe disposal of bulk waste, but also to the reduction of environmental impacts that arises due to burning of plastics. It has been tested and documented to use waste plastics in infrastructure development. Puttaraj MH et al. also reported making bricks by combining soil and plastic trash after heating. The goal of the current study is to investigate the characteristics of bricks made by combining waste plastic and sand. The results of this investigation should provide some light on whether or not these sand-plastic bricks are appropriate for usage in the building sector.

2. REVIEW OF LITERATURE

We studied various papers to manufacture fly ash brick and idea to implement

2.1 Siti Aishah Wahid, Sullyfaizura Mohd Rawi, Norlia Md Desa.

Due to the non-degradable nature of plastic, recycling vast quantities of plastic bottles has become a significant environmental concern. The amount of plastic garbage in our environment is continually rising since plastic does not breakdown organically. The suggested sand bricks, which are created by incorporating crushed plastic bottle trash into sand bricks, may help with the problem of disposing of plastic waste by reusing the waste as one of the bricks' additive materials. Compressive strength, water absorption, and efflorescence of sand bricks with varied amounts of plastic were evaluated. It demonstrates that adding crush-type plastic waste to sand bricks may significantly increase the performance of such materials. The current study analyses plastic waste materials in various proportions of 0% to 15% that were added to the raw material to manufacture plastic waste sand bricks in order to use plastic waste for the manufacturing of sustainable construction materials. As a result of the examination, suggestions are made after reviewing the bricks' compression strength. It was shown that the compressive strength loss brought on by replacing sand with old plastic bottles is minimal and may even be enhanced by a dosage of super plasticizer. However, the efflorescence and water absorption both worked nicely.

2.2. Puttaraj Mallikarjun Hiremath, Shanmukha shetty, Navaneeth Rai.P.G, Prathima.T.B

Between the supply of traditional building materials and demand, there has recently been a significant mismatch. The biggest challenge in disposing of waste plastics (PET, PP, etc.) is that only a small portion of PET bottles are recycled, and repeated recycling of PET bottles could turn the material into one that is carcinogenic. Nevertheless, there is a surplus of laterite quarry waste.. In this study, an effort was made to produce bricks using waste plastics that ranged in weight from 60 to 80% of the waste from a laterite quarry, along with bitumen of 60/70 grade that was added in amounts between 2 and 5% by weight of soil when it was molten and combined with the waste from the laterite quarry to create the bitumen-plastic resin.

In order to meet the rising need for traditional construction materials, the produced bricks have qualities like smooth and uniform finishing, little water absorption, and enough compressive strength as compared to laterite stone.

2.3. Ronak Shah, Himanshu Garg

The major goal of this research project is to provide an effective method for utilising the waste plastic that poses a serious threat to maintaining ecological balance as well as to lessen the plastic waste that is growing every day. Plastic trash has negative repercussions that are felt all around the world. Therefore, in an effort to address this problem, a plastic extruder machine is being used to lessen the difficulty in disposing of plastic trash. Extruder machines make use of plastic waste and transform it into usable building materials. By creating a brick that is both affordable and ecologically beneficial, this study also intends to reduce the amount of soil that is wasted during the production of burnt bricks. The benefit of plastic dust brick in terms of strength, economics, etc. is demonstrated by a comparison of burned brick and plastic dust brick. The plastic dust brick underwent a compression strength test, and it was discovered to have a strength of 6.66 N/mm2, which is higher than red clay bricks, which have a compressive strength of 3-5 N/mm2.

2.4. Singhal et al (2017),

Plastic garbage is a non-biodegradable waste that cannot disintegrate, causing contamination of the air, water, and land. Additionally, since plastic garbage was being burned at the landfill, its proportion was rising quickly. After ten years, it is predicted that the amount of plastic garbage would quadruple due to the hundreds of different plastic grades that are used on a daily basis. We now need to recycle and repurpose plastic garbage. It was beneficial for civil engineering to invent anything new in this area as a civil engineer. Therefore, it was decided to try making some creative plastic sand bricks or tiles. Basically, earth-based clay is traditionally used in bricks and tiles. It demonstrates the effects of resource depletion and environmental deterioration since clay is utilized extensively. For the experiment, plastic waste included drinking water bottles (polyethylene terephthalate), carried bags, bottle caps, household items (high density polyethylene), milk pouches, sacks, carried bags, bin linings, cosmetic and detergent bottles (low density polyethylene), bottle caps and closures, detergent wrappers, biscuits (poly propylene), electrical fittings, handles and knobs (urea formaldehyde), casting, bonding fibers (polyester resin), etc. To do this, the plastic trash must be burned on a furnace and crushed into tiny particles (Bhatti). additionally utilized hot stone dust as fine aggregates (size less than 4. 75mm) (Bhatti). Now

combine heated plastic trash with hot stone dust, then pour the mixture into molds to create bricks and tiles. After the aforementioned process, it would be obvious that the bricks and tiles had qualities that were much superior to those of regular bricks and tiles, such as less water absorption, a high compressive strength, a smooth surface, unbreakabaleness, reduced weight, etc.

3. METHDOLOGY

The procedure for using plastic trash in the production of bricks with fly ash may be broken down into a number of phases, which are detailed below:

Waste plastics are collected and sorted: At this point, plastic garbage is gathered from a variety of places, including homes, businesses, and waste management facilities. The garbage is then categorised according to kind, colour, and quality. This is significant because the chemical characteristics of various plastics might vary and have an impact on the end product's quality.

Pre-processing of Plastic Waste: After being separated, the plastic waste needs to be cleaned and treated to get rid of any impurities including dust, filth, and other pollutants. After being shred into tiny bits or granules, the waste plastic is ready for mixing with other materials.

Preparation of Fly Ash: A major component used in the production of bricks is fly ash, a byproduct of coal-fired power plants. In order to prevent moisture, the fly ash must be gathered and kept in a dry location.

Mixing of Plastic Waste and Fly Ash: In this step, a suitable ratio of plastic waste and fly ash is combined. After that, water is added to the mixture to create a paste-like consistency.

Molding of Bricks: The paste-like substance is poured into various sized and shaped molds. The mixture is then compressed and any extra water is drained from the molds. After that, the bricks are allowed to cure for a few days.

Curing of Bricks: The bricks are cured at a high temperature in a kiln once they have dried. The bricks are strengthened and any leftover moisture is removed during this procedure.

Testing of Bricks: The evaluation of the bricks' quality is done in the last step. The bricks' durability, water absorption, and compressive strength are assessed. The bricks are prepared for use in building if they pass the quality inspections.

In summary, the use of plastic waste in the production of bricks with fly ash is a successful strategy for lowering plastic waste and advancing sustainable development. However, it is important to ensure that the quality of the bricks is not compromised, and proper testing is conducted to ensure their safety and durability.

2. EXPERIMENTAL RESULT

A. COMPRESSION STRENGTH TEST

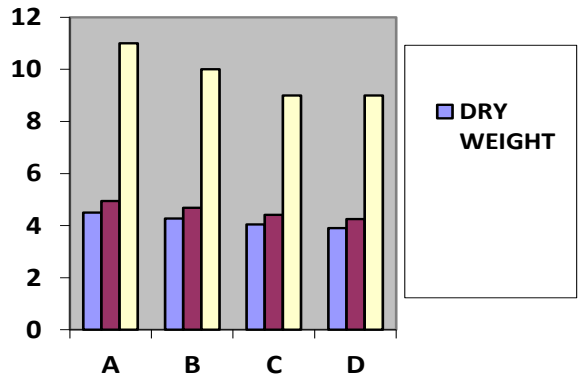
The specimen should be carefully centered between the testing machine's plates with its flat faces horizontal and its face filled with mortar facing upward. In order to determine the maximum load at failure, apply load axially at a constant rate per minute until failure occurs. The specimen fails to produce a further increase in the value of the indicator on the testing instrument at the highest load, which is referred to as the load at failure.

SR. NO.	SAMPLE NAME	COMPRESSIVE STRENGTH (N/mm^2)			MAX. LOAD (KN)
		5%	10%	15%	AVG.
1	Without Plastic	Total	Strength.=	23	600
2	7 Days	7.05	7.68	5.70	194
3	14 Days	7.8	8.06	7.02	230
4	28 Days	7.95	8.0	6.5	235

B. WATER ABSORPTION TEST

Completely dry the specimen and submerge it for 24 hours in clean water at a temperature of 27 2 °C. After removing the sample and using a wet towel to remove any remaining water, weigh the sample. Complete the weighing 3 minutes after the specimen has been removed from water (W2). Water absorption, percent by mass, after 24-hour immersion in cold water is given by the following formula:

$$\frac{W1-W2}{W1} X\ 100$$



C. EFFLORESCENCE TEST

Place the bricks' ends in the dish with a 25 mm depth of water in it. Place the entire setup in a warm (for instance, 20 to 30°C) well-ventilated room for whatever long it takes for the specimens to absorb all of the water in the dish and the excess water to evaporate. Cover the dish holding the brick with a suitable glass cylinder to prevent excessive dish evaporation. After the water has been absorbed and the bricks appear to be dry, add an equal amount of water to the dish and let it evaporate as before. Check the bricks for efflorescence after the second evaporation and report the results.

SR. NO.	SAMPLE NAME	EFFLORESCENCE
1	A	MODERATE
2	B	
3	C	
4	D	

D. Soundness Test:

Bricks are tested for soundness to determine their resistance to rapid impact. In this experiment, two bricks are randomly selected and struck against one another.. Afterward, the sound made should be a crisp bell ringing sound, and the brick shouldn't crumble. It is then regarded as a nice brick.

SR NO.	SAMPLE NAME	RESULT OF SOUNNDNESS TEST
1	A	PASSED
2	B	PASSED
3	C	PASSED
4	D	PASSED

SR. NO.	SAMPLE NAME	DRY WEIGHT (KG)	WET WEIGHT (KG)	% OF WATER ABSORPTION
1	A	4.5	4.95	11%
2	B	4.27	4.69	10%
3	C	4.05	4.41	9%
4	D	3.90	4.25	9%

3.OBJECTIVES

1. The maintenance of ecological balance is seriously threatened by plastic waste, hence it is important to create effective methods for using waste plastic.

2. To decrease the use of earth-based materials, such clay, in the production of brick, which led to resource depletion and environmental devastation.

3. To reduce the dumping of waste plastic quantities on the land and water so as to avoid land and water pollution.

4. To reduce the dumping area of waste plastics and thereby reducing health hazard.

5. To produce the cost-effective materials

4. FUTURE SCOPE

The invention of new civil engineering materials that exhibit some surprising responses in the future industry and alter the perceptions of researchers, users, and industries is made possible by plastic sand bricks. They also provide us hope for the future and a method to work on plastic-related innovations. For instance, in pursuing

1. Plastic dust benches in the parks.

2. Plastic dust tracks for running and jogging in place of concrete or stone tracks.

3.Research on Composition of plastic with fly ash, Quarry dust etc.

5. CONCLUSION

1.The plastic dust brick consist of waste materials and therefore cost is very low compared to conventional bricks.

2.As we know that plastic waste is very dangerous for our environment and is generated in huge quantity from this

project we can understand plastic can be used in construction.

3.The manufacturing of bricks using fly ash is environment friendly.

4. The light weight, affordable price, friendly to the environment, and capacity to safeguard fertile soil and purify water while utilizing byproducts are further benefits of fly ash bricks..

5.This method is suitable for the countries which has the difficult to dispose /recycle the plastic waste.

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