AN EXPERIMENTAL CONCRETE BRICK, REPLACING A PORTION OF M-SAND BY USING SAW DUST AND RECYCLED PLASTIC WASTE

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Abstract-The use of alternative materials in the construction industry is becoming increasingly popular due to their potential for sustainability and cost-effectiveness. This study focuses on the development of experimental concrete bricks partially replaced with M-sand, plastic, and sawdust. Here we maintained saw dust percentage as constant (5%) and the percentage of plastic added was 10%,15%,20%,25% in our mix. The objective of the study was to evaluate the mechanical and physical properties of the bricks, including compressive strength, water absorption, and density. The results showed that the addition of M-sand, plastic, and sawdust had a positive impact on the compressive strength of the bricks, while reducing their density and water absorption. The study concludes that the use of M-sand, plastic, and sawdust in concrete bricks can be a viable solution for sustainable construction practices, with potential benefits in terms of cost, environmental impact, and performance.

Keyword- Concrete, Construction material, minerals, plastic waste, saw dust

1. INRODUCTION

Concrete bricks are widely used in the construction industry due to their strength and durability. However, the production of conventional concrete bricks requires a significant number of natural resources and energy, which can have negative environmental impacts. To address these concerns, researchers have been exploring alternative materials and techniques for making concrete bricks.

In this experiment, we investigated the use of M-sand (manufactured sand) as a partial replacement for conventional sand in the production of concrete bricks. Additionally, we added plastic and sawdust as additives to the mix to enhance the properties of the bricks and reduce their environmental impact.

M-sand is a by-product of the quarrying process and is made by crushing granite or other hard rocks. It has a similar particle size and shape to natural sand, making it a suitable replacement material. Plastic and sawdust were chosen as additives due to their abundance and potential to enhance the properties of the bricks.

The objective of this experiment was to produce concrete bricks with improved properties and reduced environmental impact. We tested the bricks for compressive strength, and water absorption, to evaluate their performance compared to conventional concrete bricks.

The results of this experiment could have significant implications for the construction industry by providing a more sustainable alternative to conventional concrete bricks.

1. LITERATURE REVIEW

M-sand: Several studies have been conducted to investigate the effect of M-sand on the properties of concrete. According to Abhishek and Kulkarni (2019), M-sand has a higher fineness modulus and water absorption than

natural sand. They found that the compressive strength of concrete made with M-sand was higher than that made with natural sand, and that the workability of the concrete was also improved. Similarly, Karthikeyan et al. (2019) investigated the effect of M-sand on the mechanical properties of concrete and found that it improved the compressive strength and modulus of elasticity.

Plastic: The use of plastic in concrete has also been studied extensively. According to Sathishkumar et al. (2020), the addition of plastic fibers to concrete can improve the tensile strength and reduce the shrinkage of the material. Similarly, Karthikeyan et al. (2018) found that the inclusion of plastic waste in concrete could improve the strength and durability of the material, as well as its resistance to water penetration. However, some studies have also reported that excessive amounts of plastic can have a negative impact on the properties of concrete, such as reducing its compressive strength (Chandrappa and Khan, 2018).

Sawdust: Sawdust is a byproduct of the woodworking industry and has been studied as a partial replacement for sand in concrete. According to Ayub et al. (2020), the use of sawdust in concrete can improve its thermal insulation properties and reduce its weight. They also found that the compressive strength of the material decreased with increasing sawdust content. However, other researchers have reported different findings. For example, Reddy and Naidu (2019) found that the compressive strength of sawdust-reinforced concrete was higher than that of conventional concrete.

Combination of M-sand, plastic, and sawdust: The combination of M-sand, plastic, and sawdust in concrete brick production has been investigated in a few studies. According to Balaji and Venkatesh (2020), the addition of plastic waste and sawdust to concrete bricks can improve their thermal insulation properties, reduce their weight, and enhance their compressive strength. Similarly, Ananthi and Jayamathi (2021) found that the use of M-sand, plastic waste, and sawdust in concrete bricks could improve their compressive strength and reduce their water absorption

In conclusion, the literature suggests that the use of M-sand, plastic, and sawdust in concrete brick production can improve the strength, durability, sustainability, and thermal insulation properties of the material. However, the optimal amounts and proportions of these materials may vary depending on the specific application and local conditions. Further research is needed to explore the potential of these materials for concrete brick production and to develop optimized methods and techniques for their use.

3. MATERIALS

The cement used for this present research was of grade 43 and the extra materials added was sawdust and plastic. Plastic is poly propylene which is light weight and has a high melting point making it suitable to use in any temperature applications. It has several applications in making packaging materials, toys, automotive parts. Saw dust is a fine powdered by-product of woodworking. Coarse aggregate and fine aggregate used are M-sand which is less than 4.75mm sieve and coarse aggregate which is greater than 4.75mm sieve. Percentage of saw dust is kept constant in every mix and the percentage of plastic is varied.

4. MIX DESIGN

- Mix Proportions 1:2:5
- Cement =180 kg/m^3
- Sand =362.5 kg/m^3
- Coarse aggregate=968.7 kg/m^3
- W/C ratio=0.46=81 kg/m^3

Here we maintained saw dust percentage as constant (5%)

- M0- Conventional mix
- M1- 10% plastic
- M2- 15% plastic
- M3- 20% plastic
- M4- 25% plastic

5. TESTES ON BRICK

Compression testing is a common method used to determine the strength of concrete bricks. Here is a general procedure for compression testing on concrete bricks: Compressive strength refers to the ability of a material to withstand compressive forces without breaking or deforming. It is a fundamental mechanical property used to assess the strength and durability of various materials, such as concrete, metals, rocks, and composites

Water absorption test is a commonly used method to determine the porosity and permeability of concrete bricks. It helps to assess the quality and durability of the bricks, as excessive water absorption can lead to various issues such as reduced strength, cracking, and deterioration over time.

Density testing is an important quality control measure for concrete bricks. The density of a concrete brick is determined by its composition and the compaction process used during manufacturing. Here's a general procedure for conducting a density test for concrete bricks:

6. RESULT ANALYSIS

Based on experimental study, following conclusion can be drawn regarding the strength behaviour of concrete brick. The study was conducted to find the optimum mix percentage of plastic brick. However, the brick specimen of size 300mm X 150mm X 190mm were cast for different mix percentage of 10%, 15%, 20%, 25% of plastic and 5% of saw dust in each proportion. However, the specimen has been tested for four mix proportion. The mechanical properties such as compressive strength, density, water absorption were studied for different mix proportion, From the results it was inferred that the minimum value for density of a normal concrete brick should be not less than 1800kg/m^3,here the obtained value is 2152.04 kg/m^3.In the case of water absorption bricks after immersion in cold water for 24 hours, water absorption shall not be more than 20% here the obtained water absorption value is 4.34%.In the case of compression test the maximum optimized compressive strength is obtained for optimal mix percentage of plastic20%, saw dust 5%, m-sand 75%, of preparation 6.2N/mm^2.As per Is2185-1 the normal brick strength is between 4.0 and 5.0N/mm^2 respectively. Our experimental brick strength: 6.2 N/mm^2. Therefore, our experimental brick provides compressive strength than normal compressive strength which enables it to use in construction purposes.

Tab.1 Compressive strength of brick in different curing period

Mix ID	Saw dust %	Plastic %	Compressive strength N/mm^2		
			7 days	14 days	28 days
M0	-	-	4.1	5.2	5.9
M1	5	10	2.1	2.2	3.2
M2	5	15	4.3	4.5	5.4
M3	5	20	4.9	5.7	6.2
M4	5	25	3.2	3.6	3.7

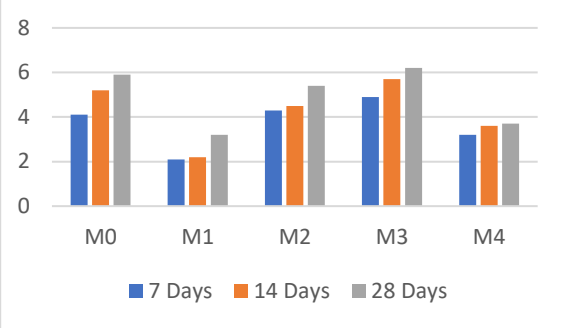

Fig.1 Graph of compression strength of bricks

7. CONCLUSION

It would be helpful to have more information about the specific proportions and methods used in the experiment, as well as any data collected on the properties of the resulting bricks such as strength, durability, and environmental impact.

Without this information, it is impossible to assess the feasibility or effectiveness of this approach as a potential alternative to traditional concrete bricks. Further research and testing

would be necessary to determine the viability and potential benefits of this experimental approach.

REFERENCES

1. M.Clement, Dr.P.Krishnakumar, M.Athipathy, M. Vijayakumar. AN "Experimental Study on Bricks Manufactured Using M-Sand, Saw Dust and Recycled Plastic" International Journal of Advanced Research in Engineering and Technology (IJARET) Volume 10, Issue 4, July-August 2019,
2. V.Kasselouri-Rigopoulou, S. Gavela, S. Kolias"Use Of Polymeric Wastes in The Concrete Production" Polymers in concrete: a vision for the 21st century, Cement & Concrete Composites 21: (1999)449-452.
3. L.R Schroeder, "The Use of Recycled Materials in Highway construction", Public Roads, Vol 58, Issue 2, 1994.
4. Zhang, L., 2013. Production of Bricks from Waste Materials-A Review. Construction and Building Materials, 47: 643-655 (1979).Definition of terms relating tomethods of mechanical testing. ASTM
5. D1037-11 of standard E6 - 76, part 10, Philadelphia PA.
6. Dr.prahallada M.C and Dr.prakash K.B "strength and workability characteristics of waste plastic fibre reinforced concrete produced from recycled aggregates" international journal of engineering research and applications(IJERA) ISSN:2248-9
7. Arora, A. and U.V. Dave, 2013. Utilization of E-Waste and Plastic Bottle Waste in Concrete. International Journal Students Research in Technology & Management, 1 (4): 398-406.
8. Rai, B., S.T. Rushad, B. Kr and S.K. Duggal, 2012. Study of Waste Plastic Mix Concrete with Plasticizer. ISRN Civil Engineering, 2012
9. Zhang, L., 2013. Production of Bricks from Waste Materials-A Review. Construction and Building Materials, 47: 643-655.
10. Raju and R. Chauhan, 2014. An Experimental Study on Strength Behaviour of Cement Concrete with Use of Plastic Fibre. National Conference on Advances in Engineering and Technology, pp: 30-34.