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Utilization of non-biodegradable waste for Manufacturing of Brick along with M-sand

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Abstract - The exponential rise in the production of plastic and the consequential surge in plastic waste have led the scientists and researchers look out for innovative and sustainable means to reuse/recycle the plastic waste in order to reduce its negative impact on environment. Construction material, converting waste plastic into fuel, household goods, fabric and clothing are some of the sectors where waste plastic is emerging as a viable option. Out of these, construction material modified with plastic waste has garnered lot of attention. Modification of construction material with plastic waste serves a dual purpose. It reduces the amount of plastic waste going to landfills or litter and secondly lessens the use of mined construction materials, thereby mitigating the negative impact of construction industry on environment.
The plastic waste is naturally available in surplus quantity and hence the cost factor comes down. Also coloring agents can be added to the mixture to attain desired shades. Hence in this thesis, an attempt is made to study regard the properties of the brick which is manufactured using plastic wastes. The present work deals with the manufacturing and analysis of bricks made with waste plastic (LDPE) and fine aggregates. The bricks produced are light weight, have smooth surface and fine edges, do not have cracks and have high crushing strength and very low water absorption.

Key Words: reuse, mitigating, environment, manufacture, analysis, attempt.

1.INTRODUCTION

The concept of manufacturing plastic bricks was we utilize the plastics waste, which is generated by people door to door, also the construction industry takes huge market in the current scenario, utilization of waste in such construction industry may play a major role. The main important thing while using the waste in plastic bricks was it cannot be made by recycling but just burn to plastic waste without adding any additives and it can also be used for at least 30-40 years in construction industry. Plastic could be a quite common material that's currently wide utilized by everyone within the world. Plastic plays a predominant role in reusable during this age, because it is compact and lightweight in weight. Common plastic things that area unit used area unit covers, bottles, and food packages. The nice downside with plastic is its decomposition. Plastic is created of compound chemicals and that the area unit was non-biodegradable.

This suggests that plastic won't decompose once it's placed on earth. Plastic could be a helpful material that's versatile, robust, and rigid they become waste once their use and that foul the air and land. Utilization is the process used waste materials into new merchandise to stop the waste of probably helpful materials. The rise in the quality of victimization ecofriendly, low-value, and light-weight construction materials within the building trade have caused the requirement to research however this may be achieved by benefiting the atmosphere also as maintaining the fabric needs and their standards. From the benefits of plastic utilization, the procedure is employed.

2. Materials

Plastic: By definition the plastics can be made to different shapes when they are heated in the closest environment it exists in different forms such as cups, furniture's, basins, plastic bags, food, and drinking containers, and they become waste material. Accumulation of such wastes can result in hazardous effects on both human and plant life. Therefore, the need for proper disposal, Waste management in respect to plastic can be done by recycling. If they are not recycled then they will become a big pollutant to the environment as they do not decompose easily and also not allow the water to percolate into the soil and they are also poisonous. And, if possible, the use of these wastes in their recycled forms occurs. Waste plastic will not absorb any moisture at any time any source.

Foundry Sand: Waste foundry dust (WFD) is a by-product of all foundry processes and accounts for the second largest proportion of total foundry waste, after waste foundry sand (Kosec et al., 2008). WFD is very small (μm-scale) and has a similar composition to waste foundry sand, which consists mostly of SiO_2, but has higher Fe content (5–80%) due to the influence of cast iron (Fiore and Zanetti, 2007, Coronado et al., 2016, Nowacki and Lis, 2018). In addition, most of the Fe in WFD exists in the form of magnetite due to the high-temperature conditions present during foundry processes. The small particle size results in a large surface area, and the high content of Fe present as reactive magnetite indicates that WFD has potential as an adsorbent.

M-Sand: Manufactured Sand (M-Sand) is sand produced from hard granite stone by crushing. The crushed sand is of cubical shape with grounded edges. It is then washed and graded with consistency to be used as a substitute of river sand as a construction material. The table-4 shows the properties of m-sand.

3. Methodology

1. Collection of plastic waste: Collection the plastics waste and segregate the waste as per its structure and specification.

2. Treated foundry dust: Collection of Foundry dust from foundry industries like ferrous and non-ferrous industry. These are waste sand or mud used for molding purpose of steel to form the structure as per the specification.
3. Drying of plastic: Dry the segregated waste for at least 24 hours to remove the moisture content present in the plastic waste.
4. Grinding of plastic: Grind the plastic waste into small and tinny pieces to reduce the energy input in the process.
5. Heating of plastic to form liquid: Heat the grinded plastic waste from 170◦c to 260◦c to the melting point of the plastics to form into liquid to properly mix the liquid plastic with the foundry dust.
6. Heating of foundry dust: heat the foundry dust to 150◦c for the killing of microorganisms present in it.
7. Mixing of liquid plastic and foundry dust: Pour the foundry dust into liquid plastic and mix it well.
8. Pouring of mix into mould: Apply oil and gyres on the inner surface if mould before poring of the mix. Pour the mix into mould with proper tamping using temping rod with round bolted head.
9. Demoulding of brick: Demould the brick after 24 hours of poring.

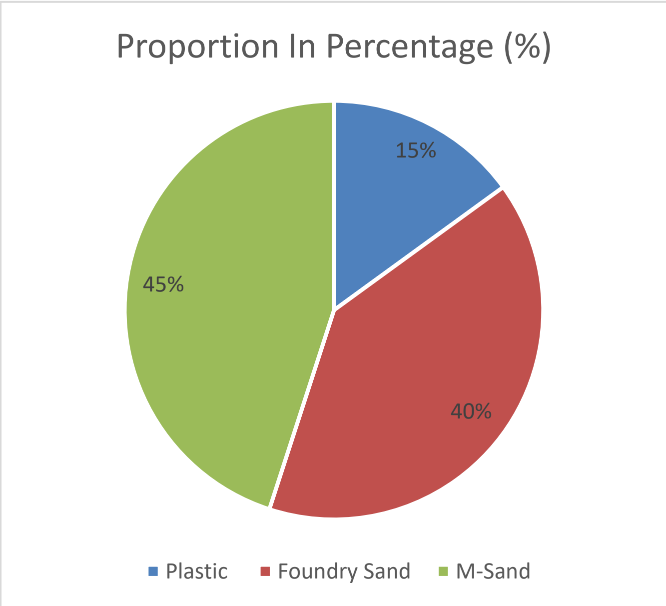

Chart No.: 1 Material Proportion.

Fig No.: 1 Melting of plastic and moulding of brick.

Fig No.: 2 Plastic Foundry sand Brick.

4. Results

Water Absorption of Brick for external use must be capable of preventing rain water from passing through them to the inside of walls of reasonable thickness. A good brick should absorb water maximum 1/7 th of the weight of the brick. Water absorption of this brick is about 2.825%. water absorption of plastic, foundry sand & m-sand brick is less as compared to other class of brick as 1st class brick absorb minimum 20% more weight of water in 24hours.

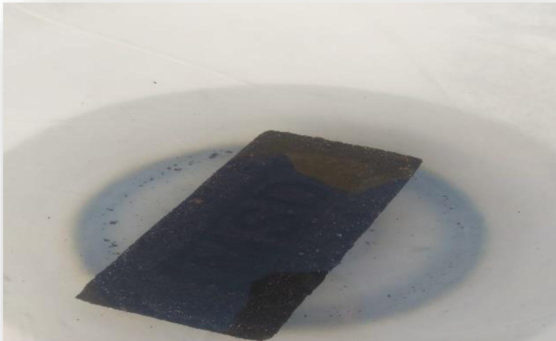

Fig No.: 3 Water Absorption Test.

Bricks are mostly subjected to compression and tension. The pressure at which the brick shatters should exceed a minimum of 3.50 N/mm2. Any value lower than that indicates that the brick is not suitable for construction. The maximum compressive strength of this brick is about 4.24 N/mm2. The maximum load carried by the brick is 115.5 kN. As we have also tested third class brick and we achieve about 6% more compressive strength than it.

Fig No.: 4 Compressive Test of the Brick.

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The carbon footprint refers to the total amount of greenhouse gases, primarily carbon dioxide (CO2) but also including methane (CH4), nitrous oxide (N2O), and fluorinated gases, emitted directly or indirectly by human activities, products, or processes, usually expressed in equivalent tons of CO2. The carbon emission of this brick is less than compared to the traditional brick as it just releases less carbon about 8.03 Kg of CO2 for per brick which almost 15 % of the traditional brick.

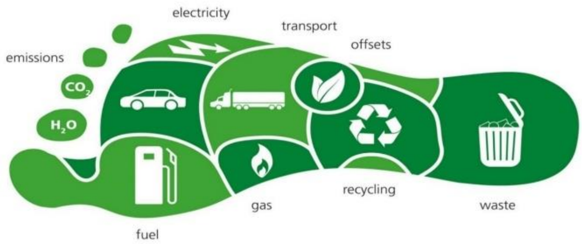

Fig No.: 5 Carbon Footprint.

Efflorescence of the Plastic, Foundry sand & M-sand Brick is less than traditional brick as its water absorption is less as compared to the traditional brick.

5. CONCLUSIONS

The research and experimental work attempted to reduce the intensity of plastic and its disposal problem by reusing discarded plastic waste to make High-Density Polyethylene (HDPE) and Polypropylene (PP) plastic bricks. These bricks have several advantages over a conventional brick of standard brick. The Compressive Strength of Foundry, Plastic and M-sand Brick is more than 3rd Class brick and hence it is greater than 3.5 MPa. It is more than the brick made in that mold with red clay burnt brick. The carbon emission of the Foundry, Plastic and M-sand Brick is less than compared to red clay burnt brick, as the carbon emission for furnace of burnt clay brick is for 15 days and required more time to use as curing time is also more. Curing of Foundry, Plastic and M-sand Brick is less. The Foundry, Plastic and M-sand Brick can be used for less important structure and toilet blocks as it has less water absorption capacity. It may be also used for the parapet of structures and area where the wall is expose to rain.

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