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Styrofoam bricks.

Ladrillos de poliestireno.

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ABSTRACT

Pollution and accumulation of waste is one of the major problems that the present world faces. Of the waste materials the non-degradable plastic waste is the major issue. Among the plastic wastes, Styrofoam wastes share the lion's share. Styrofoam wastes are non-degradable also possess the threat of poisonous gas emission when burnt the main challenge is to recycle without the emission of poisonous gases. In this thought we come to the idea of Styrofoam bricks. The Styrofoam brick mainly consists of Styrofoam, acetone and sand. Styrofoam bricks can be manufactured through 4 kinds of process, dissolution of Styrofoam in acetone, mixing with sand, moulding and drying. Why we are preparing this brick is to get high strength and reduced weight also it is not brittle like the ordinary bricks. This will have good load bearing capacity. It can be used to construct partition wall, pavement, roofing etc.

Key Words: Polystyrene Foam; Lightweight Bricks; Thermal Insulation; Pore-Forming.

RESUMEN

La contaminación y acumulación de desechos es uno de los principales problemas que enfrenta el mundo actual. De los materiales de desecho, los desechos plásticos no degradables son el principal problema. Entre los desechos plásticos, los desechos de espuma de poliestireno comparten la parte del león. Los desechos de espuma de poliestireno no son degradables y también presentan la amenaza de emisión de gases venenosos cuando se queman, el principal desafío es reciclarlos sin la emisión de gases venenosos. En este pensamiento llegamos a la idea de los ladrillos de poliestireno. El ladrillo de poliestireno se compone principalmente de poliestireno, acetona y arena. Los ladrillos de espuma de poliestireno se pueden fabricar mediante 4 tipos de procesos, disolución de espuma de poliestireno en acetona, mezcla con arena, moldeado y secado. La razón por la que estamos preparando este ladrillo es para obtener una alta resistencia y un peso reducido, además, no es quebradizo como los ladrillos comunes. Esto tendrá una buena capacidad de carga. Se puede utilizar para construir tabiques, pavimentos, O techos.

Palabras clave: espuma de poliestireno; Ladrillos ligeros; Aislamiento térmico; Formación

de poros.

INTRODUCTION

Some bricks advantages include relatively cheap have high compressive strength, corrosion resistant, relatively simple in construction, and relatively resistant to fire. However, bricks have one weakness that the unit weight is high enough so that the dead load on a structure to be great. While as average mass of modular brick unit was found to be 1.8 kg and mass density came out to be 1.06g/cm3. Therefore, it is necessary to develop bricks with light weight to reduce the weight of the building. Earthquake loads that work will be smaller because the weight of the structure is reduced, so that the structure will be safe and suitable for residential buildings in the earthquake area. Basically, all kinds of lightweight bricks produced with a large number of air content, both within and between the grain aggregate benchmark. The compressive strength Styrofoam brick is higher than the ordinary bricks, Butit is not recommended as main structures such as columns and beams, or if will be applied only for a lightweight structure. Styrofoam bricks also can be used as a non-structuralelement such as walls of buildings. Wall is the largest component in the building, so if the wall has a light weight it can affect the overall weight of the building. However, the light weight is not enough, must have a waterproof capability as well. The walls are not water resistant would be damp and dangerous to health. Exposure to water-damaged indoor environments and subsequent fungal and bacterial growth leads to a variety of symptoms that are often overlooked by the medical profession. Thus it is necessary to study the composition of lightweight bricks wall but also has a waterproof capability.

MATERIALS

CEMENT

Cement is the one of the binding materials in this project, ingeneral, adhesive substances of all kinds,but, in a narrower sense, the binding materials used in building and civilengineering construction. Cements of this kind are finely ground powders that, when mixed with water, set to a hard mass. Setting and hardening result from hydration, which is a chemical combination of the cement compounds with water that yields submicroscopic crystals or a gel-like material with a high surface area. Because of their hydrating properties, constructional cements, which will evenset and harden under water, are often called hydraulic cements. The mostimportant of these is Portland cement.

FINE AGGREGATE

Sand is a granular materialcomposed of finely divided rock and mineral particles. It

is defined by size, being finer than gravel and coarser than silt. Sand can also refer to a textural class of soil or soil type, a soil containing more than 85 percent sand-sized particles by mass.

WATER

The water used for mixing and curing should be clean and free from injurious quantities of alkalis, acid, oils,salt, sugar, organic materials, vegetable growth and other substances that may be deleterious to bricks, stone, concrete or steel. Potable water is generally consideredsatisfactory for mixing. The pH value ofwater should be not less than 6.

STYROFOAM

The Styrofoam waste is collected from different areas so as to reduce the accumulation of non-degradable waste generation. Styrofoam contains the toxic substances Styrene and Benzene, suspected carcinogens and neurotoxins that are hazardous to humans. Hot foods and liquids actually start a partial breakdown of the Styrofoam, causingsome toxins to be absorbed into our bloodstream and tissue.

Fig.1 Styrofoam wastes

EXPERIMENTALPROCEDURE

Manufacturing of Bricks

There were no clear past details aboutthe project. And there is no hard procedure for casting bricks. So the procedure that is given below was followed by our own. And the equipment’s which were used in this project are for our convenience only.

MOULD PREPARATION

After collecting the materials, a mould was prepared. This mould was non-water absorbing in the size of 200mmX100mmX90mm the shorter sides of the mould is slightly to serve as handle. And joints not reduce the Styrofoam to these small cells for example; if you tear it into small pieces with your fingers your bricks will not hold together.were made without anyhole or gap to avoid leakage.

GRINDING OF STYROFOAM

To use Styrofoam to make Styrofoam bricks, you must break it down into its smallest pieces. We callthis fuzz. It flies everywhere and sticks all over.

MIXING

We experimented with many ratiosof Styrofoam fuzz and cement powder before settling on 1:2:4 .bricks use a lot of Styrofoam, neither break nor crumble easily, bear a big load, provide good thermal and sound insulation, and are light and inexpensive. Our standards may not be yours, and our standards are not scientific. We cannot test, for example, load-bearing capacity. Wherewe work, however, contractors use brick as infill between load-bearing columns and do not build load-bearing brick walls. Our brick, therefore, needs only tosupport its own weight to a height ofthree meters. If you chose to go ahead and use foam cement, it is easy to make and use. You will require

- Styrofoam fuzz,
- Cement,
- Water,
- A large mixing container,
- A bucket to use as a standardmeasure,
- Some kind of brick makingmachine or mould
- Drying area.

MOULDING

The prepared mix is then place to the mould of required dimensions; Bricks are the easiest product to make with styrofoam cement mix. Can be make bricks using wooden molds or a simple machine. The molds are easy and inexpensive to make.

DRYING

After removing the mould, placethem to dry in a sunny spot or at least where they will not be subjected to heavy rain in the first day. They are very fragile until they set. Dry for three days before using.

Fig. 2 Drying

RESULTS AND DISCUSSIONS

After casting the bricks, they wereanalyzed for using as a brick. Varioustests were carried out to check the properties of the brick. And the results ofthe test were analyzed with the existing and standard results. The following tests were carried out to check the strength of the brick

WEIGHT

The ordinary convectional bricks weigh varies from 3 to 3.75kg but the Styrofoam bricks weight varies from 2 to2.5kg.the maximum weight is 2.75 kgonly. So the bricks are light weight and itwill also reduce the total cost of construction due to the reduction in dead load.

COMPRESSION TEST

For uniform and comparable results, follow a standard and consistentprocedure in making the entire test Bricks whether they are used either for standardor for control tests.

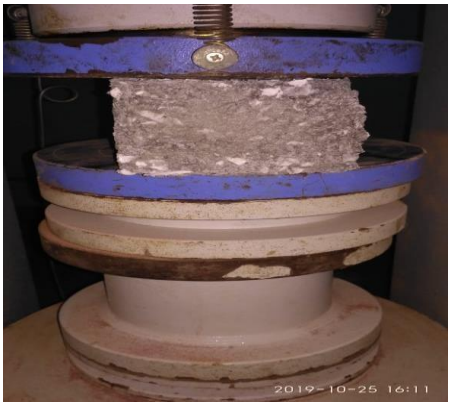

Fig. 3 Compression testing

Compressive strength = ultimate load (N) / sectional area (mm^2)

On an atomic level, the molecules or atoms are forced apart when in tension whereas in compression they are forcedtogether. Since atoms in solids always try to find an equilibrium position, and distance between other atoms, forces arise throughout the entire material which oppose both tension and compression. The phenomena prevailing on an atomic level are therefore similar.

The "strain" is the relative change in length under applied stress; positive strain characterizes an object under tensionload which tends to lengthen it, and a compressive stress that shortens an object gives negative strain. Tension tends to pullsmall sideways deflections back into alignment, while compression tends to amplify such deflection into buckling.Compressive strength is measured on materials, components, and structures.

Compressive strength of Styrofoambrick is 11.25 N/mm2.

WATER ABSORPTION TEST

Water absorption test on bricks is conducted to determine durability propertyof bricks such as degree of burning,quality and behavior of bricks in weathering.

A brick with water absorption of less than 7% provides better resistance to damage by freezing. The degree of compactness of bricks can be obtained by water absorption test, as water is absorbed by pores in bricks.The water absorption by bricksincrease with increase in pores. So, the bricks, which have water absorption less than 3 percent can be called as vitrified.

This test provides the percentage of water absorption of bricks and procedure of the same is discussed below.

Apparatus

A sensitive balance capable ofweighing within 0.1% of the mass of the specimen and ventilated oven.

Specimen

Three numbers of whole bricks fromsamples collected for testing should be taken.

Procedure of Water Absorption Test

- Dry the specimen in
- a ventilated oven at a temperature of 105 °C to 115°C till it attains substantially constant mass.
- Cool the specimen to room temperature and obtain its weight (M1) specimen too warm to touch shall not be used for this purpose.
- Immerse completely dried specimen in clean water at a temperature of 27+2°C for 24 hours.
- Remove the specimen and wipe out any traces of water with damp cloth and weigh the specimen after it has been removed from water (M2).

Calculation of Water Absorption of Bricks

Water absorption, % by mass, after 24 hours immersion in cold water is given by the formula,

$$W = \frac{M_2 - M_1}{M_1} X\ 100$$

The average of result shall be reported.

Result

Water absorption of the given bricks = 11.25%

Water Absorption Values for Brick,

When tested as above, the average water absorption shall not be more than 20% by weight up to class 12.5 and 15% by weight for higher class.

CONCLUSION

From the ratio obtained, 20% of Styrofoam waste has optimum range compared to conventional bricks based on experimental observations, the following conclusions are drawn.

- Use of waste material results in the formation of lightweight concrete.
- Due to less weight of these bricks, the total dead load of the building will be reduced.
- Using the Styrofoam in bricks, total cost will be reduced from 20% to 50%

- Since, the recyclable aggregate material used, it will reduce the landfills and pollution.
- Use of such waste material not only cuts down the cost of construction, but also contributes insafe disposal of waste materials.

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