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"The Use of Waste Plastic as Building Material"

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Abstract:

Plastics are the material which is Non-bio degradable and takes a huge number of years to decay. It makes water just as land-contamination which influences the earth. The plastic waste quantity is expanding rapidly through the year. The use of plastic waste is increasing day by day and year by year. The most largest plastic waste is polyethylene. The utilization of clay materials for construction purpose is result in resource depletion and environmental degradation. The required clay amount is huge in the making of bricks, We use the plastic waste effectively in the order to save the land space by reducing plastic waste. We used polyethylene bags and plastic bottles in some percentage for this research which shows more compressive strength and minimum water ratio as compare to normal clay bricks.

Keywords

Non-Biodegradable, Polyethylene, Depletion, Degradation, Compressive strength, Water ratio.

Introduction

It is estimated that about more than 280 millions of waste produced worldwide every year from that 130 millions of plastic is recycled or land filled. Other 150 million tons plastic is used by human beings in daily life. The plastic waste is a big threat which effect the environment directly because of their toxic chemical composition and therefore it pollutes air, water and soil if it is not properly managed or treated. The most accessible plastic in this day and age is comprised of non-biodegradable materials, land-filling of plastic implies that covering the destructive material for over extensive stretches to corrupt it normally. Plastic materials increment the waste volume during land-filling. Be that as it may, their debasement rates and cumbersome in nature bring into reality are unsafe for condition. The plastic waste is also contaminating the ground water stream. Plastic waste is a very thin film component, when they stirred up with downpour water and water can obstruct soil and get water which can diminish pace of permeation and which break down the dirt richness when it blended in with soil. The plastic wastes which are disposed into the surface water like drains, rivers and sea water it create imbalance in the life of aquatic animals like fishes etc.

In this project we use the plastic waste effectively in the order to save the land space by reducing plastic waste. We use the polyethylene bags and plastic bottles in some percentage for this research which shows more compressive strength and minimum water ratio as compare to normal clay bricks.

Literature Review

Plastic waste is a non-biodegradable waste which cannot decompose and this creates water pollution, land pollution and air pollution. It is estimated that the plastic waste double after or decade as we use 100 grades of plastic in our daily life. And as we know, the 4R principle. So, as a civil engineer we have to innovate something new related to this, which is bone for civil engineering. Also we can see that cost of everything is getting increased day by day. So by keeping all this in mind we thought of an innovative idea of making **Brick using plastic and sand.** To make this project, we will collect plastic waste and then we will melt it. Then we will collect for the same and divide both into a ratio **1:3**. Then we will mix both and make a uniform paste and then we will fill it into a mould (standard size **19*9*9** or **20 * 10* 20**) which is in the size of original brick. And then we will leave it for making it solid. Then we will test it so to check out whether it is good for construction purpose or not. The test would be- Water absorption test, Compressive strength test, Thermal Resistance Test. Basically in bricks and tiles, we used earth based clay. Due to excessive use of the clay, it shows the result of resources of depletion and environmental degradation (Polyester resin) etc. We observed that the characteristic of plastic sand bricks and tiles is far much better than normal bricks and tiles as minimum water absorption, highly compressive strength, smooth surface, unbreakable, light weighted, less cost effective etc.

Material Specifications

Plastics:

Plastic is that type of material which plays a very important role in the life of each and everyone's life. Plastic is generated in all over the world in very large quantity and this need to be managed properly. The large amount of plastics are mainly found in

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containers and packing's like cups, bottles and packing etc. as well as, various building materials and disposable items. Plastic can be classified on various grounds such as chemical properties, density, manufacturing techniques, mechanical properties and thermal properties.

Table 1: Availability of Plastic waste

Sr. No.	Waste Plastic	Available as
1	Poly-ethylene terephthalate (PET)	Water bottles etc.
2	High Density Polyethylene(HDPE)	Polyethene bags, bottle caps, etc.
3	Low Density Polyethylene(LDPE)	Milk bags, carry bags, bin linings, detergents bottles and cosmetics etc.
4	Poly propylene(PP)	Bottle caps and closures, wrappers of detergents, biscuits etc.
5	Urea formaldehyde	Electrical knobs, handles and fittings etc.
6	Polyester resin	Casting, bonding fibers (glass, Kevlar, carbon fiber) etc.

Sand:

Sand is a finely divided granular material which occurs due to deterioration of rocks and minerals. Size, fineness, texture, color are the properties which define sand. Geographical and hydrological conditions also affect the formation and properties of sand. Silica is the most common constituent found in sand. The second common sand is Carbonate, for example, "Aragonite" that has been created over million years, by various types of aquatic life, like shellfish and coral. Sand is a non-renewable resource and used to make concrete in large demand.

Natural river sand used as a fine aggregate. The properties of sand were determined through the use of density bottle and sieve.

Methodology:

Batching:

At first the plastics are cleaned with water and dried it so that the water should not present in it and then weight it and then we sieve the sand by the utilization of 1.18mm sieve. The sand and the plastic jugs have been said something different extents among which the plastic had been taken for consuming procedure.

Burning:

Subsequent to clumping the plastic have been taken for consuming in which the plastic are tossed independently into the drum and permitted to soften. The initial step of consuming strategy incorporates the plan of stones, drum and the necessary kindling. The stones are composed to hold the drum and the kindling is situated in the hole among stones and it's far touched off. The drum is put over the arrangement and it's miles warmed to evacuate the dampness found in it.

Mixing:

Then put the plastics individually into the drum, until the entire plastic substance get used in making the blocks. Then by using trowel mix the hot plastic well before it gets harden.

Moulding:

Then the aggregate is poured into the brick mould and is then compacted through the use of tamping rod or metallic rod. The surface is completed with the aid of using trowel. Prior to placing the blend into the buildup, the edges of the form are oiled to smooth evacuation of blocks. Shape expelled following 24 hours.

Curing:

After the compaction has been done we have to allow to dry it for 24 hours. Then the specimen is kept in curing tank and allow to cure for a period of 7 days, 14 days and 28 days.

Tests on Bricks

Compression Strength Test:

The brick specimens was set in compression testing machine and the heap is to be applied without stun and increment ceaselessly at a pace of roughly 140 kg/cm2 min till the rising burden separates the example and it can't manage further quality. The most extreme burden applied to the examples is to be recorded and the presence of the block any uncommon highlights in the kind of disappointment is noted.

Compressive Strength = Maximum load/ Area of specimen

$=P/A$

Where,

P = maximum load (N)

A = area of the specimen (mm2)

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Table 2: Compressive strength of various Plastic- Sand Ratios

Sr. No.	Plastic-Sand Ratio	Compressive Strength(N/mm2)
1	1:2	7.55
2	1:3	8.08
3	1:4	8.55

Water Absorption Test:

After drying the bricks, they're dried and drenched in water for 24 hours and after these 24 hours of inundation, the one brick is taken out from the curing tank and crash with fabric. At that point, block is said something wet situation. The contrast between loads is the water assimilated through block. Retained water is determined in rate. If the brick absorb less water, brick is of better quality. The maximum water absorption is limited to 20%.

Water absorption = {[W2 – W1]/W1} x 100

Where,

W1 = Weight of dry brick (kg)

W2 = Weight of wet brick (kg)

Table 3: Water Absorption of various Plastic- Sand Ratio (%)

Sr. No.	PLASTIC-Sand Ratio	Water Absorption (%)
1	1:2	3.65
2	1:3	3.18
3	1:4	2.10

Efflorescence Test:

The white layer on the block or brick which is unsafe. We do this test to verify the presence of alkali material in bricks/blocks. The bricks get dipped in fresh water and allowed to dry in shade. The nonattendance of whitish layer demonstrates the nonappearance of alkalis. If the white layer on the surface of brick is 10% then it is satisfactory. If it is 50% on the surface then it is moderate. If it is above the 50% then the brick/block is heavily effected by alkalis.

Table 4: Efflorescence Test of Various Plastic-Sand Ratios

Sr. No.	Plastic-Sand Ratio	Acceptable	Non-Acceptable
1	1:2	Yes	-
2	1:3	Yes	-
3	1:4	Yes	-

Hardness Test:

In the check a scratch is made on brick floor with metallic rod (any difficult cloth can be used) which turned into difficult to suggest the bricks or blocks had been hard. This suggests the brick own excessive high-quality.

Table 5: Hardness Test of Various Plastic-Sand Ratio

Sr. No.	Plastic-Sand Ratio	Result
1	1:2	Satisfied
2	1:3	Satisfied
3	1:4	Satisfied

Soundness Test:

The check examples after compaction have been permitted to dry for a time of 24 hours. The examples have been spared in standard restoring tank and permitted to solution for a span of 7 days, 14 days and 28 days.

Table 6: Soundness test of various Plastic-Sand Ratio

Sr. No.	Plastic-Sand Ratio	Result
1	1:2	Satisfied
2	1:3	Satisfied
3	1:4	Satisfied

Result and Discussion

Compressive Strength Test:

While doing compressive strength test on bricks we have to determine the capacity of brick that the brick can bear while compression using compression testing machine. And the range of compressive strength test on brick is:

1. First class bricks – 10.7 N/mm2
2. Second class bricks – 7 N/mm2
3. Third class bricks – 3.5 N/mm2

Water Absorption Test:

In water absorption test to check durability of bricks we have to conduct this test to check the quality and behavior of bricks in different weathering conditions. And the range of water absorption of bricks after 24 hours of immersion of different classes of bricks:

1. First class bricks – 20 %
2. Second class bricks – 22 %
3. Third class bricks – 25 %

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Efflorescence Test:

After drying process if there is any whitish layer deposit on the surface of brick that will show the presence of soluble salts on the bricks.

Table 7: Condition of Efflorescence Test

OBSERVATION	RESULT
No perceptible deposit	Nil- Efflorescence
10% are covered with deposit of salts	Slight – Efflorescence
50% of area covered with deposit of salts without any powdering or flaking surface	Moderate Efflorescence

Hardness Test:

If we do any scratch with metallic thing and sharp things then if there is no scratch impression on the brick that means the bricks are hard.

Soundness Test:

If there is ringing sound when we stuck the two bricks then the sound produced is clear and bricks are not broke then it is a good bricks.

Conclusion

1. Waste plastic, which is available everywhere, may be put to an effective use in brick/tiles making.
2. Plastic sand brick/tiles can help reduce the environmental pollution, thereby making the environment clean and healthy.
3. Plastic sand brick/tiles reduce the usage of clay in making of bricks/tiles.
4. Plastic sand bricks/tiles give an alternative option of brick/tiles to the customers on affordable rates.
5. It will also help in management of plastic waste and will prove as great relief to municipal bodies.

Future Scope

Plastic sand bricks supply us hope and way to work on progressive matters associated with the plastic and to try to invent some new civil engineering materials which shows a few brilliant response in future enterprise and adjustments the thoughts of the researchers, person and industries. Such as, in going for plastic sand wall in framed systems as a partition wall, plastic sand benches within the parks, plastic sand tracks for walking and running in place of concrete or stone tracks.

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