Study on Solid Brick Made with Waste Plastic and Estuary Sand

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***Abstract*—A Plastic waste which is expanding step by step moves towards becoming high and also dirties the earth, particularly in high mountain towns and visitor trekking areas where no rubbish accumulation framework exists and furthermore which are disposed of or which prompts the pollution of land and air. The transfer of waste plastic is the greatest test, as continued reusing of plastic waste bottle containers represent a potential risk of being changed to a cancer-causing material and just a little measure of plastic waste bottles is being reused.**

Thus, the plastic waste bottles are included with estuary sand at different ratios to acquire good quality solid Bricks. By using waste plastic bottles as a binder and estuary sand as aggregate in production of solid Bricks will reduce the disposal of waste plastic bottles and also, we get to know the properties and characteristics of estuary sand.

I. INTRODUCTION

Now a Days plastic waste is an important issue for everyone and needs to resolve on an urgent basis, as its hazardous effects is deteriorating life on Earth. Waste in form of plastic is increasing day by day, but a permanent solution to it is still not found and the waste today can be produced wherever humans' footprints exists. The amount of plastic waste is ever-increasing due to increase in human population, developmental activities and changes in life style. Even economic growth and changing consumption patterns are resulting in the rapid increase in the use of plastic.

Nowadays plastic waste disposal is one of the major problems faced by the whole world, the recycling of plastic material can be done 2-3 times only, because after every recyclingthe plastic material deteriorates due to thermal pressure and its life span is reduced hence recycling is not safe and permanent solution for Plastic waste disposal. Plastic products have become integral part of our daily life as a result polymer is produced all over the world. On an average, production of plastic globally crosses 150 million tonnes per year. The major production of plastic is for wrapping materials, bags, for production of household and industrial products etc.

Once plastic is discarded after its useful life is over is known as plastic waste. The fact that plastic waste never degrades, and remains on the landscape for several years. Most plastic is reusable but as we know that recycled products are more harmful to the environment as it contains additives and colors.

Only 60% of the plastic produced is recycled and the rest of the plastic is being buried or dumped into the dump yards, and landfills. The land fill causes waste of useful land and decreases the fertility rate of the land.

II. OBJECTIVES

- To know the properties of estuary sand and plastic waste bottles to make a solidbrick.
- To compare the strength of solid brick which is made of estuary sand withconventional sand.
- To minimize the use of landfills which is affecting the earth's surface.
- To produce cost-effective materials which a common person can afford easily andwith ease of construction.
- To develop an efficient way to effectively utilize plastics.

III.MATERIALS AND METHODOLOGY

Plastic Waste Bottle

Most of today's plastic beverage bottles are made of polyethylene terephthalate (PET). Generally plastic is soft. If heated plastic does melt at 954 degrees Celsius. Its melting point of plastic is 1934 degrees Celsius. It is a solid so plastic at room temperature has no viscosity but when melted it is very viscous. The

disadvantages of plastic water bottles release 2.5 million tons of carbon dioxide into the atmosphere annually. Disposable waterbottle waste washes into the ocean and kills 1.1 million marine creatures each year. Approximately 36 percent of all plastics produced are used in packaging, including single-use plastic products for food and beverage containers, approximately 85 percent ofwhich end up in landfills or as unregulated waste.

Collection of waste plastic bottles

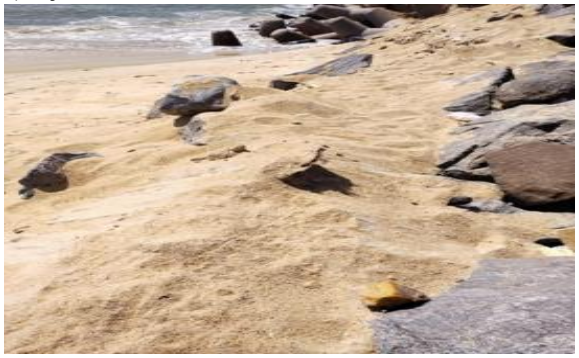
Estuary Sand

An estuary is an area where a freshwater river or stream meets the ocean. In estuaries, thesalty ocean mixes with a freshwater river, resulting in brackish water. Brackish water is somewhat salty, but not as salty as the ocean. An estuary may also be called a bay, lagoon, sound, or slough.

Types of Estuaries

There are four different kinds of estuaries, each created a different way:

1) Coastal plain estuaries
2) Tectonic estuaries
3) Bar-built estuaries
4) Fjord estuaries.



Collection of estuary sand

Cement

A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement mixed with fine aggregate produces mortar for masonry, or sand and gravel, produce concrete. Concrete is the most widely used material in existence and is behind only water as the planet's most-consumedresource. Cement used in construction is usually inorganic, often lime or calcium silicate based, which can be characterized as non-hydraulic or hydraulic respectively, depending on the ability of the cement to set in the presence of water.

Cement

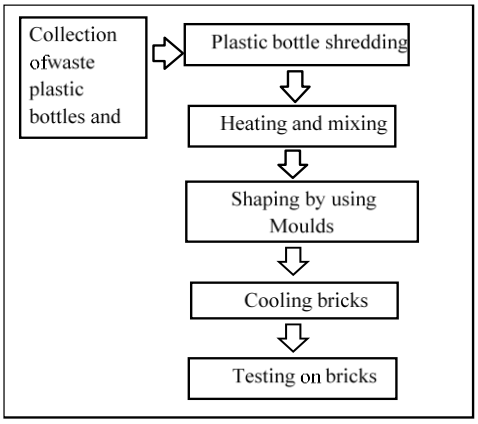
Sand

Sand is a granular material composed of finely divided rock and mineral particles. Sand has various compositions but is defined by its grain size. Sand grains are smaller than gravel and coarser than silt. Sand can also refer to a textural class of soil or soil type; i.e., soil containing more than 85 percent sand-sized particles by mass. The composition of sand varies, depending on the local rock sources and conditions, but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica(silicon dioxide, or SiO_2), usually in the form of quartz-sand is a non-renewable resource over human timescales, and sand suitable for making concrete is in high demand. Desert sand, although plentiful, is not suitable for concrete. 50 billion tons of beach sand and fossil sand are used each year for construction.

Sand

Methodology

- This is to study on solid brick made with waste plastic as a key material and by using estuary sand as an aggregate, we are going to prepare a solid brick of size 190×90×90 mm.
- By collecting waste plastic bottles and shredding them for proper mixing with 'estuary' sand, after dry mixing the material is to be transferred to the melting process.
- After melting the melted material is to be kept for cooling and once after cooling the material is to be transferred to a mould of standard size.



Flow chart showing Methodology

IV. TESTS ON BRICKS

Compressive Strength

- This test is done to know the compressive strength of brick. It is also calledcrushing strength of brick.
- Generally, 6 trials of bricks taken to the laboratory for testing and tested one byone. The First 3 bricks are estuary sand and plastic waste bottle brick, with latertrials of conventional brick.
- In this test, a brick specimen is put on the crushing machine and applied pressuretill it breaks.
- Finally, the ultimate pressure at which the brick is crushed is taken into account.

Compressive test on Brick

Soundness test

The soundness test is also done in the field. The Plastic bricks and conventional bricks are were taken. The bricks are made to hit each other the ring sound produced duringthe process, which denotes the quality of the brick that it isgood. Good quality bricks produce the clear ringing sound. In our project both fly ash bricks and plastic sand bricks clear ringing sound produced.

Water absorption test

Four specimens of bricks were taken and weighed in dry condition (W1). Letthem immersed in fresh water for 24 hours. After 24 hoursof immersion, those are taken out from water and wipe outwith cloth. Then brick is weighed in wet condition (W2). The difference between weights is the water absorbed by bricks. The percentage of water absorption is calculated. The less water absorbed by bricks the greater its quality. Good quality brick doesn't absorb more than 20 % water of its own weight.

Hardness test

In this test a scratch is made on brick surface with steel rod(any hard material can be used) which was difficult to imply the bricks or blocks were hard. This shows the brick possess high quality.

As per the code IS 3495 (1992): Common Burnt clay building brick - specification the above tests are to be performed. Compressive strength test, Water absorption test and Efflorescence test. In addition, there two more tests to be conducted to know the quality of Plastic bricks. In these tests some are to performed in a laboratory and reston the fields with a reference of literatures and journals.

V. OUT COMES AND RESULTS

TRIALS	RATIO	PLASTIC BOTTELS (gm)	ESTUARY SAND (gm)	BRICK WEIGHT (kg)
1	50:50	700	700	1.588
2	60:40	2300	1533	2.077
3	70:30	2500	1071	2.900

Details about the trials

Trial-1

Trial-2

Trial-3

Ratios	Compressive strength, Mpa
50:50	3.16
60:40	5.44
70:30	3.80

Compressive strength for solid brick made with waste plastic bottles and estuary sand

Curing Period in days	Compressive strength, Mpa
7	4.87
14	5.57
21	9.55

Compressive strength for conventional solid brick

Sl no	Dry weight(w1) in kg	Wet weight(w2) In kg	W2-W1	% of water content
1	1.835	2.00	0.165	8.99%

Water absorption test for plastic bricks

Sl no	Dry weight(w1) in kg	Wet weight(w2) In kg	W2-W1	% of water content
1	3.90	4.650	0.75	19.23%

Water absorption test for conventional bricks

VI. CONCLUSION

By conducting various tests on plastic bricks made with waste plastic and estuary sand its noted that the compressive strength of plastic bricks of 60:40 ratio is acceptable & other bricks made with different ratios I;e (50:50) and (70:30) are not having the didn't meetthe required acceptable compressive strength of a brick. It shows that the increased plasticconstituents in bricks lead to less compressive strength.

The reduced compressive strength values of waste plastic bricks mixes show that it can beused only in situations that required a low degree of workability. Such situations are numerous in civil engineering applications namely precast bricks, partition wall panels, and canal lining.

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