DEVELOPMENT OF BIO-WEEDS COMPOSITE BRICKS WITH GRANITE POWDER

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***Abstract*: Brick is a composite material made from clay, water, fine aggregate. But researchers are in interest of finding new materials by waste materials are waste products which are available naturally cause harmful to the environment. This research deals with partial replacement of sand with granite powder and bio weeds. In order to overcome the harmfulness caused by bio weeds, this research is carried out. Naturally bio weeds consume more water than other plants. While carrying out this research huge amount of bio weeds are cleared. It results in increasing of water table. Government proposes special program to remove bio weeds. This research will help them. River sand is expensive due to excessive cost of transportation from natural sources. Also large scale depletion of the sources creates environmental problem. A substitute or replacement is needed. In order to overcome these difficulties granite powder is used since granite waste generated by the industry as accumulated over years. Granite powder gives more strength and durability to the brick when compared with conventional brick.**

***Keywords*: brick, bio weeds, granite powder, strength, durability, sand.**

1. INTRODUCTION

A brick is one of the main materials of a construction work. Bricks are chiefly used for making wall panels. They are the chief constituent of masonry construction. Fried bricks are used for masonry as it can withstand a large amount of load. Bricks chiefly constitutes of clay, alumina, shale and sand. In our research we intend to replace the clay partially with bio-weeds and granite powder. Both of these materials are chiefly waste materials and dumped in large quantities. The usage of materials is relatively low compared to their waste. By more usage of these materials, the waste levels are reduced. It can result in more usage of the bio-weeds and granite powder. The bricks are made with composite mixture of bio-weeds and granite powder as a partial replacement of sand. The bricks are made and are tested for their strength at various ratios. Then the bricks are tested for their strength and their optimum ratio is found. This research is done to find a better material that has high strength compared to the normal brick and more light. This also results in use of waste material in the brick which results in higher strength of the brick. The use of alternate material for fine aggregate in construction works need attention with respect to their availability and applicability. In this experimental studies were conducted to use granite powder to replace fine aggregate in brick. Granite powder may be defined as plutonic light coloured igneous rock crusher's powder. These are among the most common igneous rock crushers. The word granite is derived from latin word granum meaning a grain and obviously refers to the equigranular texture of the rocks. The consumption of cement content, workability, compressive strength and cost of concrete made with granite powder were studied by researchers.

2. LITERATURE REVIEW

Alaa A.Shakir, Ali Ahmed Mohammed et al(2014). The most basic building material for construction of houses is the conventional brick. The rapid growth in today's construction industry has obliged the civil engineers in searching for more efficient and durable alternatives far beyond limitations of the conventional brick production. A number of studies had taken serious steps in manufacturing bricks from several of waste materials. However, the traditional mean of bricks production which has brought hazardous impacts to the context has not yet been changed or replaced by more efficient and sustainable one. This paper aims to compile this state of the art work of manufacturing bricks in the past and the current trend in the bricks industry with respect to the raw materials, ways of manufacturing and the out-comings. Moreover, the hazardous impacts of the conventional brick manufacturing will be wholly covered as well as the attempts of the previous researches in treating the problem properly. This paper is an attempt to fill the gap of the past studies and suggest more sustainable and sophisticated methods of brick manufacturing in the future.

Chandana sukesh(2015), they have studies about the partial replacement of clay in brick by use of waste materials like cement kiln dust (CKD), ceramic wastes and plastic. All of these materials are industrial waste materials and termed as hazardous waste to environment. They have found that the addition of up to 15% CKD as a partial replacement has a better effect on the strength of the brick. It also gives a better compound ratio to the brick. *Different waste material used in brick* was published on December 2014.

Dr.G.Vijayakumar, et al(2015), cement manufacturing industry is one of the carbon dioxide emitting sources besides deforestation and burning of fossil fuels. The global warming is caused by the emission of green house gases, such as co_2, to the atmosphere. Among the green house gases, co_2 contributes about 65% of global warming. The global cement industry contributes about 7% of greenhouse gas emission to the earth's atmosphere. In order to address environmental effects associated with cement manufacturing, there is a need to develop alternative binders to make bricks.

3. INTRODUCTION

3.1 BRICK

A brick is a block or a single unit of a kneaded clay-bearing soil, sand and lime, or concrete material, fire hardened or air dried, used in masonry construction. Fired brick are the most numerous types and are laid in courses and numerous patterns known as bonds, collectively known as brickwork, and may be laid in various kinds of mortar to hold the bricks together to make a durable structure. Brick are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities. Fired brick are one of the longest lasting and strongest building materials and sometimes referred to as artificial stone and have been used since circa 5000 BC. Fired bricks are burned in a kiln which makes them durable.

Normally, brick contains the following ingredients:

1. Silica (sand) – 50% to 60% by weight
2. Alumina (clay) – 20% to 30% by weight
3. Lime – 2 to 5% by weight
4. Iron oxide – ≤ 7% by weight
5. Magnesia – less than 1% by weight

The soft mud method is the most common, as it is the most economical. It starts with the raw clay, preferably in a mix with 25–30% sand to reduce shrinkage. The clay is first ground and mixed with water to the desired consistency. The clay is then pressed into steel moulds with a hydraulic press. The shaped clay is then fired ("burned") at 900–1000 °C to achieve strength.The standard size of brick in India is set at 228mm × 107mm × 69 mmand9in × 4¼in × 2¾ in. The size of brick varies for various countries and also for various purposes. Some bricks are made in innovative sizes and shapes when used for plastering where their inherent mechanical properties are more important than their visual ones. Hence this results in varied brick sizes.

3.2 MANUFACTURE OF BRICK

Brick is made of clay or shale formed and fired into a durable ceramic product. There are three ways to form the shape and size of a brick: extruded, molded and dry pressed. The majority of the brick are made by the extrusion method. Brick shrink during manufacturing process as vitrification process occurs. Bricks vary in size due to the manufacturing process. These variations are addressed by the ASTM standards. Most brick manufacturing facilities are near clay sources to reduce transportation, by recycling of process waste, by reclaiming land where mining has occurred, and by taking measures to reduce plant emissions. Most bricks are used within 500 miles of a brick manufacturing facility.The manufacturing process has six general phases:

1. Mining and storage of raw materials
2. Preparing raw materials
3. Forming the brick
4. Drying
5. Firing and cooling
6. De-hacking and storing finished products

In India, brick making is typically a manual process. The most common type of brick kiln in use there is the **Bull's Trench Kiln** (BTK), based on a design developed by British engineer W. Bull in the late 19th century.An oval or circular trench is dug, 6–9 metres wide, 2-2.5 metres deep, and 100–150 metres in circumference. A tall exhaust chimney is constructed in the centre. Half or more of the trench is filled with "green" (unfired) bricks which are stacked in an open lattice pattern to allow airflow. The lattice is capped with a roofing layer of finished brick. In operation, new green bricks, along with roofing bricks, are stacked at one end of the brick pile; cooled finished bricks are removed from the other end for transport to their destinations. In the middle, the brick workers create a firing zone by dropping fuel (coal, wood, oil, debris, and above the trench.

3.3 CEMENT

Here the ordinary Portland cement (opc) is used. The grade of the cement is 43. The cement is manufactured by ultra-tech cement. It's one of the building material and widely used construction site. Its used in normal construction to heavy construction. Cement is provided good strength and high durability to the structure.

3.4 SAND

The sand used was clean, sharp river sand that was free from clay, loam, dirt and organic or chemical matter of any description and was sand passing through 2.36mm zone of british standard test sieves. The sand had a specific gravity of 2.27 and its density is 3.72g/cc.

3.5 GRANITE POWDER Granite powder may be defined as plutonic light colmyed igneous rock crusher's powder. These are among the most common igneous rock crushers. The word granite is derived from latin word granum meaning a grain and obviously refers to the equigranular texture of the rocks.

General content:

a) Feldspars (65 to 90%)
b) Quartz (10 to 60%)
c) Biotite or other accessory minerals (10 to 15%)

3.6 WATER

The purpose of using water with cement is to cause hydration of the cement water in excess of that required for hydration acts as a lubricant between coarse and fine aggregates and produces a workable and economical brick. The amount of water must

be limited to produce brick of quality required for job. Water also used for curing.Impurities may affect setting lime, strength, durability may cause efflorescence, surface discoloration and corrosion steel. Portable water is generally considered satisfactory for mixing and curing of brick. Water contains any sugar or an excess or acid, alkali, salt, it should not be used. Ordinary tab water was used in the preparation of brick.

3.7 BIO WEEDS

A weed is a plant considered in a particular situation " a plant in the wrong place." The term "weed" has no botanical significance, because a plant that is a weed in one context is not a weed when growing in a situation where it is in fact wanted, and where one spices of plant is a valuable crop plant. Many plants that people widely regard as weeds also are intentionally grown in gardens and other cultivated settings.

Table No: 1. Percentage of Mixing Materials in Composite Brick

Sample	Bio-Weeds		Granite Powder	
	gram(g)	Percentage (%)	gram(g)	Percentage (%)
Sample 1	1320	40	990	30
Sample 2	1155	35	1155	35
Sample 3	990	30	1320	40

3.8 TEST TO BE CONDUCTED

3.8.1 COMPRESSIVE STRENGTH TEST

This test is done to know the compressive strength of brick. It is also called crushing strength of brick.Generally3 specimens of bricks are taken to laboratory for testing and tested one by one. In this test a brick specimen is put on crushing machine and applied pressure till it breaks. The ultimate pressure at which brick is crushed is taken into account. All 3 specimens are tested one by one and average result is taken as bricks compressive/crushing strength.

3.8.2 WATER ABSORPTION TEST

In this test bricks are weighted in dry condition and let them immersed in fresh water for 24 hours. After 24 hours of immersion those are taken out from water and wipe out with cloth. Then brick is weighted in wet condition. The difference between weights is the water absorbed by bricks. The percentage of water absorption is then calculated. The less water absorbed by bricks the greater its quality. Good quality bricks don't absorb more than 20% water of its own weight.

3.8.3 EFFLORESCENCE TEST

The presence of alkalis in bricks is harmful and they form a gray or white layer on brick surface by absorbing moisture. To find out the presence of alkalis in bricks this test is performed. In this test a brick is immersed in fresh water for 24 hours and then it's taken out from water and allowed to dry in shade. If the whitish layer is not visible on surface it proofs that absence of alkalis in brick. If the whitish layer visible about 10% of brick surface then the presence of alkalis is inacceptable range. If that is about 50% of surface then it is moderate. If the alkali's presence is over 50% then the brick is severely affected by alkalis.

3.8.4 SOUNDNESS TEST

. In this test to bricks are held by both hands and struck with one another. If the bricks give clear metallic ringing sound and don't break then those are good quality bricks

3.8.5 HARDNESS TEST

In this test a scratch is made on brick surface with a hard thing. If that doesn't left any impression on brick then is good quality brick.

3.8.6 STRUCTURE TEST

In this test a brick is broken or a broken brick is collected and closely observed. If there are any flows, cracks or holes present on that broken face then that isn't good quality brick.

4.TEST ON BRICK

4.1 CONVENTIONAL BRICK

The normal brick that mainly constitutes Alumina, Lime, Sand, Magnesia and Oxides of Iron etc is known as conventional Brick. It is the commonly used Brick and is used for a long time. The soft mud method is the most common, as it is the most economical. It starts with the raw clay, preferably in a mix with 25–30% sand to reduce shrinkage. The clay is first ground and mixed with water to the desired consistency. The clay is then pressed into steel moulds with a hydraulic press. The shaped clay is then fired at 900–1000 °C to achieve strength. Then the Brick is left to air dry before it is tested.

COMPRESSIVE STRENGTH TEST

The tests made for the Brick has shown following results for its compressive strength at the normal size.

Table 2: Compressive Strength Test for Conventional Brick

SAMPLE	COMPRESSIVE STRENGTH(KN)
1	110
2	115
3	112
AVERAGE STRNGTH	112
AVERAGE STRESS	6.54N/mm^2

WATER ABSORPTION TEST

Weight of Brick in dry condition W1 = 3500 g
Weight of Brick after immersed in water W2 = 4000 g
Water absorbed W = W2-W1/W1 *100 = W = 14%

4.2 COMPOSITE BRICK

The Composite Brick is the mixed brick of Fly Ash and Saw Dust in equal ratio with the Clay. These Bricks are also light in weight compared to normal brick. But it has a higher compressive strength than the normal brick. This result shows that the composite mixture of Fly ash and Saw dust has advantage over the conventional brick**.**

Table No 3: Compressive Strength Test for Composite Brick

SAMPLE	COMPRESSIVE STRENGTH(KN)
1	125
2	134
3	140
AVERAGE STRENGTH	133
AVERAGE STRESS	7.77N/mm^2

WATER ABSORPTION TEST

Weight of Brick in dry condition W1 = 2910 g
Weight of Brick after immersed in water W2 = 3392 g
Water absorbed W = W2-W1/W1 *100= W = 16.5%

4.3 SPECIFIC GRAVITY OF SAND

S.No	Specification	Trail (g)
1	Weight of empty pycnometer	708
2	Weight of empty pycnometer + sand	1221
3	Weight of empty pycnometer + sand + water	1869
4	Weight of empty pycnometer + water	1544

CALCULATION:
FORMULA:
Specific gravity = w2-w1 / ((w2-w1) - (w3-w4)
= (1221- 708)/ (1221-708) – (1869-1544)
The specific gravity of sand = 2.73

4.4 SPECIFIC GRAVITY OF CEMENT

S.No	Specification	Trail (g)
1	Weight of empty pycnometer	708
2	Weight of empty pycnometer + cement	1221
3	Weight of empty pycnometer + cement + water	1869
4	Weight of empty pycnometer + water	1544

CALCULATION:
FORMULA:
Specific gravity = w2-w1 / ((w2-w1) - (w3-w4) = (1500-800)/ (1500-800) –(1950-1550)
The specific gravity of cement = 2.4

1.5 SPECIFIC GRAVITY OF GRANITE POWDER

S.No	Specification	Trial (G)
1	Weight of empty pycnometer	130
2	Weight of empty pycnometer +granite powder	250
3	Weight of empty pycnometer +granite powder+kerosin	442
4	Weight of empty pycnometer +kerosin	365
5	Weight of empty pycnometer +water	424

CALCULATION:

FORMULA:

Specific gravity = W5(W3-W1)/(W5+W4-W3)(W2-W1)

= 424(442-130)/((424+365-442)(250-130))

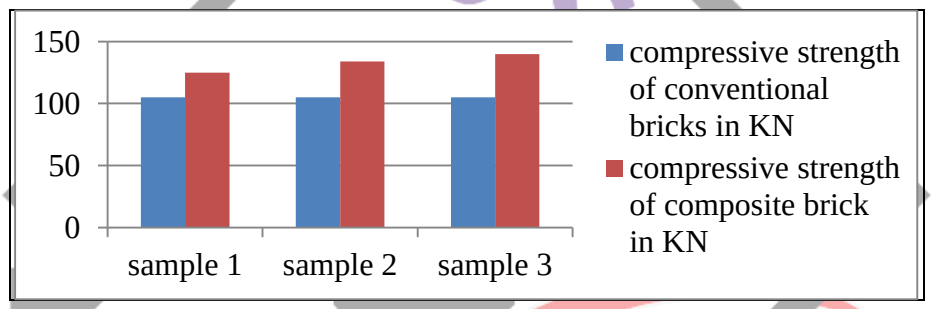
Specific gravity of given sample of granite powder =3.17

TEST RESULTS

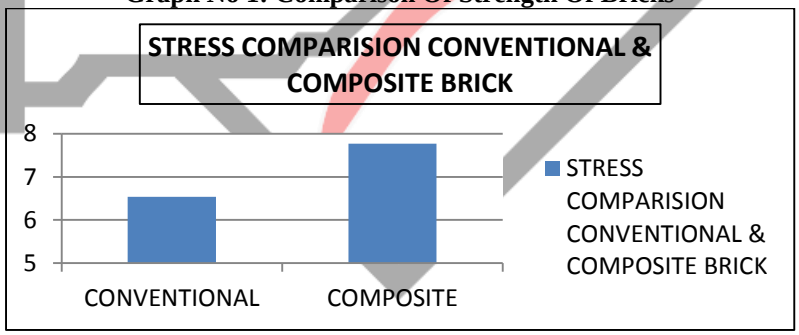
The composite bricks are made and they are tested for their strength. With the result obtained, a graph is made to represent the strength of the bricks at various ratios

Table No: 3 Comparison of the bricks

Sample	Compressive Strength in KN		Water absorption Test in %	
	Conventional Brick	Composite Brick	Conventional Brick	Composite Brick
Sample 1	110	125	14	17
Sample 2	115	134	15	16
Sample 3	112	140	14	16



Graph No 1: Comparison Of Strength Of Bricks



Graph No 2: Comparison Of Stress Of Conventional And Composite Bricks

From the graph above, it can be seen that the composite brick has highest compressive strength than the conventional brick. These bricks are lighter and give reasonable strength than the normal conventional brick. This results the better performance of the brick. They are very light in weight due to presence of bio-weeds and hence easy to carry.

Water Absoprtion Test

The water absorption test is conducted to know about the pores present in the brick. A brick is wieghed in dry condition and the weight is noted. Then the Brick is immersed in water for 24 hrs. The brick is taken out and weighed again. The change in weight of brick is calculated. The percentage of water absorbed is calculated by the formula =(W2-W1)/W1 * 100

The permissible percentage is at 20%.In our research, we have obtained the conventional brick at 15% and the composite brick had a percentage of 15.9%. This makes it more feasile with less pores in the brick.

Figure 2: Before Immeresed In Water

Figure 3: After Immeresed In Water

STRUCTURE TEST

A Composite Brick is broken and the strucute of the brick is observed. If there is no undulations are there in the brick then the brick has a better structure. This structure of the brick is compared with a conventional brick and then the result is observed.

Figure 4: Structure Test

Figure 5: Complete Structure Of Bricks

HARDNESS TEST

The hardness test is made by scratching the surface of the brick by a hard object. If there is no impression left on the brick after scratch is made, then the brick is hard and durable. Our brick has a hard surface and is strong and hence has a better structure.

SOUNDNESS TEST

The ringing of the brick when struck with another brick is proof of a good brick. We tested it by striking it with another brick and has a good ringing sound which is proof that the brick is sound.

EFFLORESCENCE TEST

The presence of soluble salts in a brick results in the alkali reaction in the brick. The formation of white precipitate in the brick due to reaction with water is proof of the presence of salts in the brick. There is only a little amount of salt in our brick which results in the brick being a good quality brick. The formation of precipitate is very low and hence is durable in the long run.

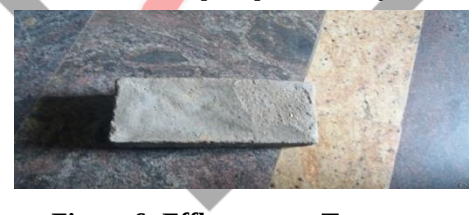


Figure 6: Efflorescence Test

6. COMPARISON OF THE BRICKS

When compared to the conventional bricks the composite bricks have the following advantages:

- Light in Weight
- Higher Compressive Strength of Brick
- Low Pore formation
- Structure of Brick is even
- Hard, Brittle and Sound
- Composite bricks has a low level of salt content results in lower level formation of precipitate in the brick.
- The weight of the brick is at an average of 2910g in dry condition and at 3392g in wet condition. The water absorption capacity 16.5% which is within allowable limits
- Thus the overall performance of the composite brick is high compared to conventional brick. It has better strength, hardness and lesser salt content in the brick. The brick is light in weight and is very easy to carry.

7.BRICK DETAIL

The mould used is of size 190mmx90mmx90mm

Figure No:7 Mould Size

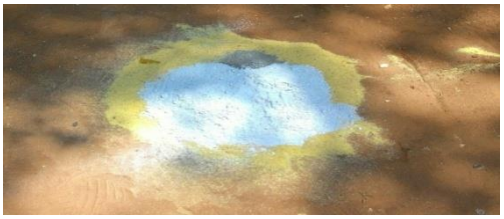


Figure No:8 Preparation of mix

Figure No:8 Manufacturing Of Brick

CONCLUSION

There has been an increase in compressive strength at low ratio levels. The weight of the bricks reduces with increase of Bio-weeds. The structure is hard, sound and free from cracks. The bricks have a better water absorption ratio than normal brick. The structure of the brick is also more brittle than the conventional bricks. Compressive strength of brick with 40% of replacement is more to referral brick in 7 days. The composite bricks have more advantages than the conventional bricks in terms of strength and water absorption properties. It requires less amount of sand. This result in the more usage of these waste materials.Our research has shown that the composite mixture of granite powder and bio weeds have more advantages than the conventional brick. It is a sustainable brick as it reduces the waste dumping and also a more usage level to the bio weeds. It is also eco-friendly and is pollution free.In our research, we also compare the rate of conventional and composite bricks. The rate of conventional brick is Rs.4.70 while our composite brick costs Rs.4.10

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