EXPERIMENTAL INVESTIGATION OF HIGH STRENGTH CEMENT BRICKS USING PERLITE

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Abstract:

Our present building materials' compressive strength and thermal insulation performance must be substantially improved due to stricter energy standards. In this study, we looked into ways to enhance cement bricks' performance in terms of compressive strength. Expanded perlite, which is normally a synthetic addition based on SiO2 and Al2O3, was used as an additive in this study. To create test samples, expanded perlite that ranged in weight percentage from 3 to 5 percent was blended into cement masses. The cement masses had a 25 weight percent moisture content. Samples were made in a lab vacuum extruder, then they were dried in the sun. compressive strength, bulk density, and water absorption. Our study's objectives were to determine whether expanded perlite could be used as an additive in the production of bricks and to compare the outcomes to those of traditional brick. After 28 days, the compressive strength test yielded the following results: 18.3 MPa for 3%, 14.6 MPa for 4%, and 10.3% for 5%. Brick containing 3% of perlite was found to have the highest compressive strength and was found to be the most effective. The identical brick has a compressive strength that is 320% more than the typical conventional brick.

Keyword: Perlite, compressive strength , substainable

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1.Introduction

This research will find a more effective technique to get rid of waste from perlite production, which is necessary for a number of industries, including filtration, civil construction, and agribusiness. Currently, brick is made using this waste perlite. Prior to that, perlite waste residue was used to fill arid quarries, which met environmental standards but resulted in

higher costs and less value for society. Perlite is an amorphous volcanic glass with 2–5% combined water that is typically formed by the obsidian, and it has a relatively high water content. When heated sufficiently, it has the ability to significantly expand. About 70% of the known world's perlite reserves are found in Turkey in the Aegean Sea. The pulverised, sieved material is heated to 760–1100°C to create the commercial product.

In the oven, the combined water in the perlite is turned into gas at a high temperature, and as a result, the volume increases 4–20 times its initial volume, producing a light, porous material. Perlite is made in a variety of grades, the most popular being 0-2 and 1.5-3.0 mm in diameter. It is often used in potting soil blends and as a stand-alone growing medium. The physical properties of the various grades vary.

2.MATERIAL AND METHODOLOGY

2.1Materials

Ordinary Portland Cement (OPC) conforming to IS: 12269 - 1987, fine aggregate, perlite, and portable water are the materials employed for this experimental effort.

Here, in this investigation, perlite is used in % place of sand. ASTRRA CHEMICALS offers perlite that is confirmed to be grade SF II Powder in the shape of 10kg bags. The by-product of the glass industry is perlite. The OPC cement used for the standard specimen is grade 53.

River sand from Vijayawada was used as the fine aggregate in this project. Cement, fine aggregate, and perlite were tested in accordance with IS: 2386-1963. Tables 1 to 3 list the material properties.

Table 1: physical properties of perlite

S.No.	Property	Value
1	Colour	White/Grey
2	Brightness ,%GE	70-80
3	Apparent density ,kg/m^3	50-300
4	Hardness index (Mohs)	5,5
5	Specific Gravity	2.2– 2.4
6	pH	6 -8.5
7	Water absorption, %of mass	200-600
8	Ability to absorb oils ,gram of oil per gram of Perlite	50-100

9	Melting point ,C°	980
10	Burn losses(3hours under tof 900°C),%	up to1,5
11	Humidity,%	up to1,0
12	Maximum strength , MPa	up too6,0
13	Porosity,%	70-85
14	Portion of air,%	80-95
15	Thermal conductivity ,W/mK	0,043-0,093
16	Thermaldiffusivity,m^2/sec	0,632-0,330

Table 2: Physical properties of Fine Aggregate

Sieve Size	**Percentage Passing**
10mm	100%
4.75mm	100%
2.36mm	99.50%
1.18mm	86.70%
600µ	35.80%
300 µ	8.60%
150 µ	0.80%
Zone	II
Fineness modulus	2.7
Specific gravity	2.6

Table 3 : Physical properties of cement

Description	**Cement**
Fineness	3.40%
Normal consistency	34%
Initial setting time	75 min
Final setting time	310 min

2.2.Procedure

The Zone of coarse aggregate is obtained through seive analysis ,also Fineness modulus and Specific gravity is known

Perlite is replaced with coarse aggregate (sand) in percent wise. After casting curing process is carried out, followed by water absorption test, compression test, efflorescence test ,hardness test , structure test

3.TEST RESULTS AND DISCUSSION

3.1Compressive Test Results

According to IS:516-1959, the specimen is evaluated on a 2000KN UTM machine. The 150mm X 150mm X 150mm standard sized cubes are put to the test fig 1,2. Table 4 shows the test results for 7^{th},14th and 28^{th} compressive strength.

Test day	**3% cube**	**4% cube**	**5% cube**
7^{th} day test	7.8N/mm2	5.8N/mm2	4.3N/mm2
14^{th} day test	11N/mm2	10.4N/mm2	7.2N/mm2
28^{th} day test	18.3N/mm2	14.6N/mm2	10.3N/mm2

Table 4 compressive strength

Fig 1compression strength

fig 2 crushing strength

3.2Water absorption test

The initial weight of the dried brick is recorded and submerged in water for 24 hours. It is removed and wiped when absorption is complete.The specimen weight is then again measured. The weight variation demonstrates the absorption of water. The amount of water absorbed is then computed. Bricks quality increases in direct proportion to how little water absorbs. A good brick wont absorb more water than 20% of itsown weight. The water absorption is calculated as follow

Absorption percent =(A-B)/B*100

Where,

A stands for the units wet mass in kg

B stands for the units dry mass in kg

Absorption percent =(1.970*1.890)/1.890*100

= 4.23%

3.3.Effloresence Test

The brick is set in plate and submerged 25mm deep in water. The experiment is conducted in warm , ventilated room until the specimen has absorbed all of the water and any excess has evaporated. In order to prevent excessive dish evaporation , an apporpriate glass cylinder is placed over the dish containing the brick. Place an equal amount of water in the dish and let it evaporate as previously once the water has been absorbed and the brick appears to be dry. The outcome of the brick is then assessed. We learned that thewhite coating only covers about 10% of the surface and that the efflorescence is rather moderate

3.4Hardness test

The bricks resistance to abrasion is assessed using the hardness test. Bricks are scratched on their surface with a fingernail during the hardness test.

The brick is considered to be frim if there is no surface imprint.

3.5Structure test

The brick is shattered and its structure is analysed in order to determine the bricks structure. As a consequence we learned that the bricks interior is is uniform and free of bumps

4. CONCLUSION:

Through this project Manufacture of perlite bricks we have come to an Know that comparing test on 7^{th} , 14^{th} and 28^{th} days test of 4% Perlite cube & 5% perlite cube has Gained lesser Compression test of bricks Comparing to 3% perlite cube have gained more compressive strength . Hence we have come to the Conclusion that 3% perlite cube have gained required compressive strength for brick.

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