EXPERIMENT ON HEMPCRETE TILES

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Abstract: This paper examines the analysis behind the employment of hempcrete, that could be a bio-aggregate concrete created from lime and hemp knife. Hempcrete could be a property artifact that's created with a coffee environmental impact that removes waste production, decreases each energy use and also the consumption of natural resources. Hempcrete locks carbonic acid gas among its fibers, has low thermal conduction, and exceptional acoustic performance and vapor porousness, that regulates the temperature within structures. Some drawbacks to the employment of hempcrete embody its capability to retain water, which might cause swelling and biodecay of the fabric, also as poor mechanical performance that presently prevents it from use as a load bearing material. However, some analysis asserts that the mechanical performance may be exaggerated, depending on what binder is employed. And then from this lets we can see the tiles that can be from hempcrete, a bio aggregate.

Key Words: Hempcrete fibers, porousness, a bio aggregate.

INTRODUCTION

The construction trade should presently modify variety of problems touching the surroundings. Among these square measure global climate change, the consumption of natural resources, non-biodegradable waste production, and therefore the overall quality of living. Additionally, the inefficient use of energy within the construction sector add considerably to those factors. As of 2008, residential and business structures were responsible for nearly four-hundredth folks energy consumption, additionally to causative up to thirty eighth of all carbon dioxide emissions. Tho' these statistics appear intimidating, the past many decades have created a shift in each policy and strategies to plot a additional property approach to construction. Some samples of this embrace the usage initiative, that helps decrease the economic impact on the environment. Additionally, different materials, like bio-aggregates, square measure being researched for a similar purpose. Thus far, one amongst the foremost promising materials has been hemp. Hemp is each an agricultural associate degreed industrial trade goods, highlighted by its quality as a property resource for associate degree estimated twenty-five thousand totally different product , additionally to its ability to soak up carbon dioxide whereas it's being full-grown. However, because it additional specifically relates to the sphere of civil engineering, hemp will be mixed with lime to make a bio-aggregate concrete, called "hempcrete". Hempcrete may be a light-weight concrete, made of hemp pulp (or shiv), and hydraulic or aerated lime. It's usually used for timber frame infill, roofing tiles, insulation, renders, and floor slabs. Although hempcrete cannot offer enough structural integrity to be used as a supporting material, it can, however, form up for its mechanical drawbacks through practicality and environmental advantages. For instance, hempcrete exhibits a coffee thermal physical phenomenon (λ= zero.1–0.2 W/m·K) that regulates the temperature and wetness levels at intervals a domicile, a high acoustic performance in comparison to traditional concretes, associate degreed an exceptional resistance to fireside while not the necessity for fire-preventative measures

1. MATREIALS USED

1.1 HEMPCRETE

It is one of the methods of decreasing the concrete density. This is done by introduction of stable air voids inside the hardened cement or mortar. The foaming agents introduced the air voids in the concrete, so it is called foamed concrete. Foamed concrete does not contain coarse aggregate; it contains only the fine aggregate that is nothing but the sand or m-sand, some light weight agents like thermocol beats, water and foaming solution.

When compared to normal concrete, it is considerably homogeneous. However, its properties depend on the microstructure and composition of concrete. Lightweight is one of the main advantages of the foamed concrete.

1.2. CALCIUM SILICATE

Calcium silicate is the chemical compound Ca_2SiO_4, also known as calcium orthosilicate and is sometimes formulated as $2CaO \cdot SiO_2$.

Properties

Calcium silicate is a white free-flowing powder. It can be derived from naturally occurring limestone and diatomaceous earth, a siliceous sedimentary rock. It is one of a group of compounds that can be produced by reacting calcium oxide and silica in various ratios. e.g. $3CaO \cdot SiO_2$, Ca_3SiO_5; $2CaO \cdot SiO_2$, Ca_2SiO_4; $3CaO \cdot 2SiO_2$, $Ca_3Si_2O_7$ and $CaO \cdot SiO_2$, $CaSiO_3$. It has a low bulk density and high physical water absorption.

USES

Calcium silicate is used as an anticaking agent in food preparation, including table salt and as an antacid. It is approved by the United Nations' FAO and WHO bodies as a safe food additive in a large variety of products. It has the E number reference E552.

It is a binding agent. It is used in the construction works that binds all the materials used. Cement mixed with the fine aggregate and water produces mortar, and it mixed with coarse and fine aggregate and with water produces concrete. In this fly ash is added as a replacement of cement in percentage.

1.3 FLYASH

This raw material are freely available in thermal power plant. If cement is used and provide uniform blending with cement is ensured.

Properties of ash fly:-(IS3812 (part 1))

Fineness 5micron IS Sieve -	410m²/kg 34%(Retained)
Specific gravity	2.2to 2.8
Soundness (maximum)	0.8mm

1.4 SILICA FUME:

Silica fume is a byproduct of producing silicon metal or ferrosilicon alloys. One of the most beneficial uses for silica fume is in concrete. Because of its chemical and physical properties, it is a very reactive pozzolan. Concrete containing silica fume can have very high strength and can be very durable. Silica fume is available from suppliers of concrete admixtures and, when specified, is simply added during concrete production. Placing, finishing, and curing silica-fume concrete require special attention on the part of the concrete contractor.

1.5 WATER

The water used in the manufacture of the concrete masonry units shall be free from matter harmful to concrete or reinforcement, or matter likely to cause efflorescence in the units and shall meet the requirements of IS 456-2000. Water hardness maximum is 100ppm. pH value of water 6.5to7.

1.6 CEMENT

It is a binding material. OPC cement is used. It provides faster strength to the bricks, besides giving improved consistent quality.

Properties of cement :-(IS12269 1987)

Compression strength	53N/mm^2
Soundness	0.8to 10mm
Specific gravity	3.15
Setting time: a) Initial , min b) Final, min	 60 600

MATERIALS TESTING

The material used to construct concrete is to be tested to find their strength. The ingredients used in concrete are as follows

Cement

Fine aggregate – Foundry sand

Coarse aggregate

CEMENT:

Cement plays a major role in concrete as it acts as a binder. It acts as adhesive to join with other materials. Cement is used in construction field which holds up all the materials together and hardens it. Cement has many grades we have used 43 grade cement which means it provides strength of 43N/mm2 after28 days of curing.

DESCRIPTION	TEST RESULT
Type of cement	Open Portland cement
Specific gravity of cement	3.15

Table 1: Cement

FINE AGGREGATE:

In this project fine aggregate refers foundry sand. Foundry sand is defined as uniformly shaped clean sand with high quantity of silica sand. They are used for ferrous and non-ferrous molds. Mostly 95 % of foundry sands are used in foundry. In our project we are using spent foundry sand. 15-20% of river sand is replaced by foundry sand.

IS SIEVE SIZE	PERCENT RETAINED	CUMULATIVE % RETAINED	PERCENT PASSING
10mm	0.00	0.00	100.00
4.75mm	5.20	5.20	94.80
2.36mm	3.00	8.20	91.80
1.18mm	8.60	16.80	83.20
600 microns	25.80	42.60	57.40
300 microns	32.80	75.40	24.60
150 microns	20.70	96.10	3.90

Table 2: Sieve analysis of fine aggregate (Foundry sand)

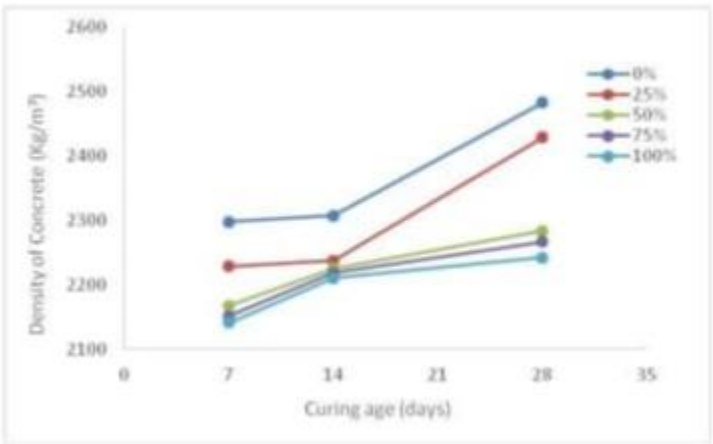
PERCENTAGE REPLACEMENT

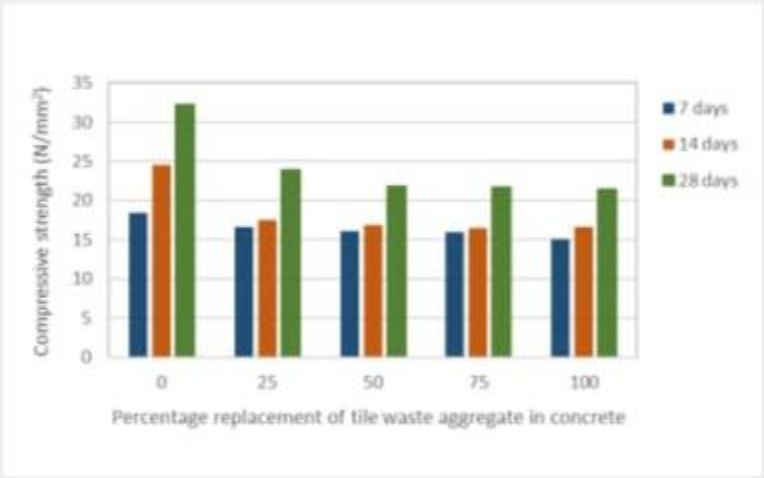
The ingredients in the hempcrete tiles were partially replaced as follows:

MATERIALS	TRAIL-I	TRAIL-II	TRAIL-III
Fly Ash	5%	10%	15%
Cement	30%	25%	20%
lime	5%	10%	10%
Silica fume	5%	10%	15%
M-Sand	25%	25%	25%
Hemp seed	30%	20%	15%

GRAPH AND RESULT

Three different trails using different ratios of fly ash, cement, lime, silica fume, and hempseed is plotted below as a graph and chart.





RESULT

As, the proportion of the hempseed and lime varies, the compressive strength of the tile also varies with that. Added amount 30 % hempseed and 5 % lime gives the maximum strength than other two proportions.