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ANALYSIS OF PROPERTIES OF CONCRETE USING EXPANDED CLAY PEBBLES AS FINE AGGRIGATES

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Abstract

Aggregate occupies most of the volume of the concrete. It is the stuff that the cement paste coats and binds together. The composition, shape, and size of aggregate all have significant impact on the workability, durability, strength, weight and shrinkage of concrete. In this paper analysis of properties of concrete using clay soil aggregates as course aggregate in concrete, transmitting temperature and temperature reduction time to normal Portland cement in different grade of concrete. Using clay soil aggregate as fine aggregate the transmitting temperature and temperature reduction time will reduces. This gives better results hence we can use clay soil aggregate as course aggregate where temperature of concrete plays an important role. Using expanded clay pebbles as fine aggregates increases the aesthetic appearance, so this can be used in manufacturing ceramics, tiles and crockeries.

Keywords: Clay Soil Aggregates; Compressive Strength; Temperature Reduction; Transmitting Temperature and Grade of Concrete.

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1. Introduction

Clay soil aggregates are fine-grained natural rock or soil material that combines one or more clay minerals with traces of metal oxides and organic matter. Clay soil aggregates are plastic state due to adhesive character to water content and become hard, brittle and non-plastic upon drying or firing [1][2][3]. The colors of soils content makes clay to appear in various colors from white to dull grey or brown to deep orange-red. Clay soil aggregates are classified into four main groups

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based on academic sources, kaolinite, montmorillonite steatite, iolite and chlorite. Approximately 30 different types of pure clays based on 'Natural' clay deposits.

The drawbacks of clay soil aggregates not using as fine aggregate is due to the shrink-swell properties, when wet and retract when dry. This clay soil is also known as expansive soil [4]. Due to the physical and chemical properties of some clays [5] huge swelling occurs when water is absorbed. As these soils dry deep cracks can form on the surface, which then allows water to penetrate to deeper layers of the soil [3].

This change of volume property of clay can cause damage to existing structures, such as cracks in foundations or the walls any structures.

The property of shrink and swell is measured by coefficient of linear extensibility.

The author has experiment the clay soil aggregates as fine aggregates as these aggregates shows adhesive characteristics and good temperature absorbing. Thus using of clay soil aggregates as fine aggregates to experience different results.

2. Methodology

Fine Aggregates of clay pebbles were collected and these aggregates are separated through all dust such as leaves, dust and other wastes.

These fine aggregates are allowed to first pass through 10mm sieve, as then 4.75mm sieve consequently. These fine aggregates are carefully handled so that no other particles must not entering inside, these aggregates then mixed with course aggregates and cement to form concrete powder using proportions, as per IS10262-2009

An empty spaced cube with bottom, size of 10*10*10cmcasted using concrete with pebbled clay used fine aggregate concrete and walls of thickness 1cm was prepared. Water of 100^0c was filled in empty cube and the time consumed for reduction of temperature of water to 40^0c was noted down.

An empty cube casted by using clay pebbled used fine aggregate concrete size 10*10*10 was inserted into another larger empty cube casted using plane cement concrete size of 5*15*10cm. 3cm sufficient space was left between two cubes was filled with Water of 100 degree centigrade and top side of cube was closed by lid. Water temperature inside the clay cube was noted down after 8mins for 1, 7, 14, 21, 28 days of similar casted samples.

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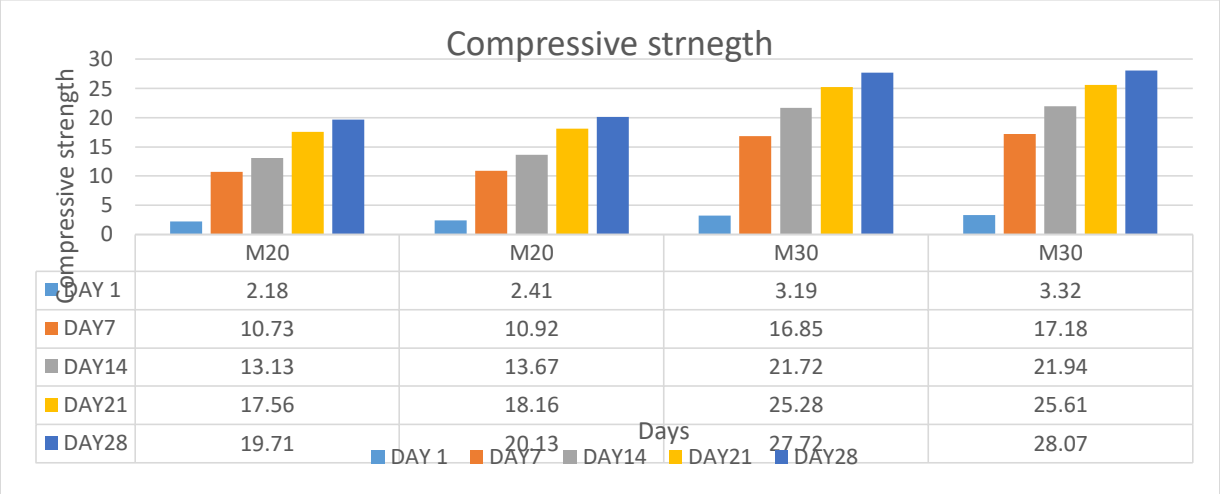
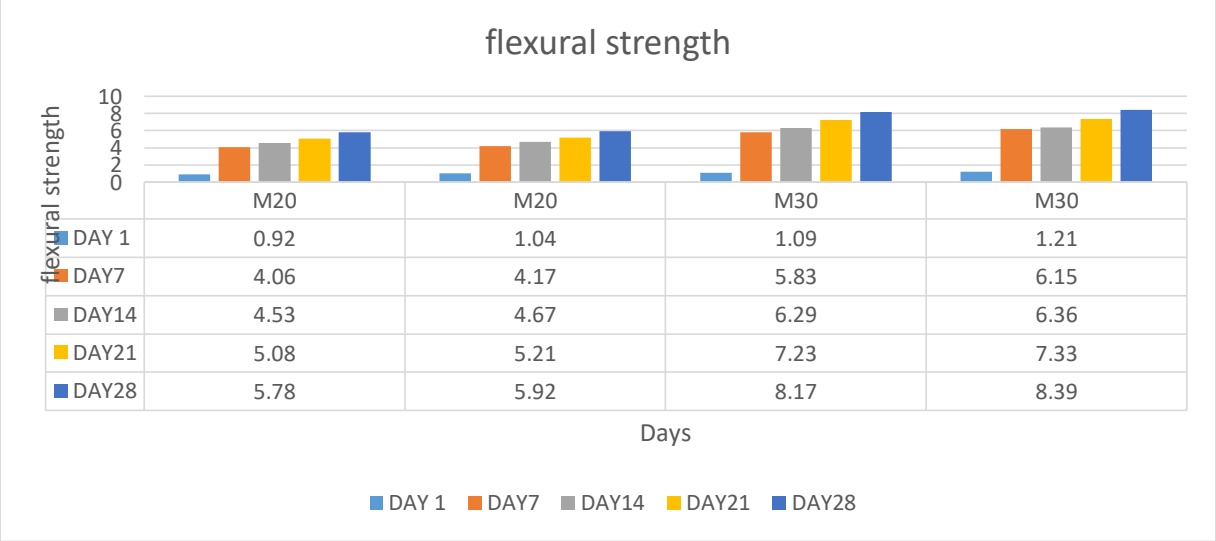
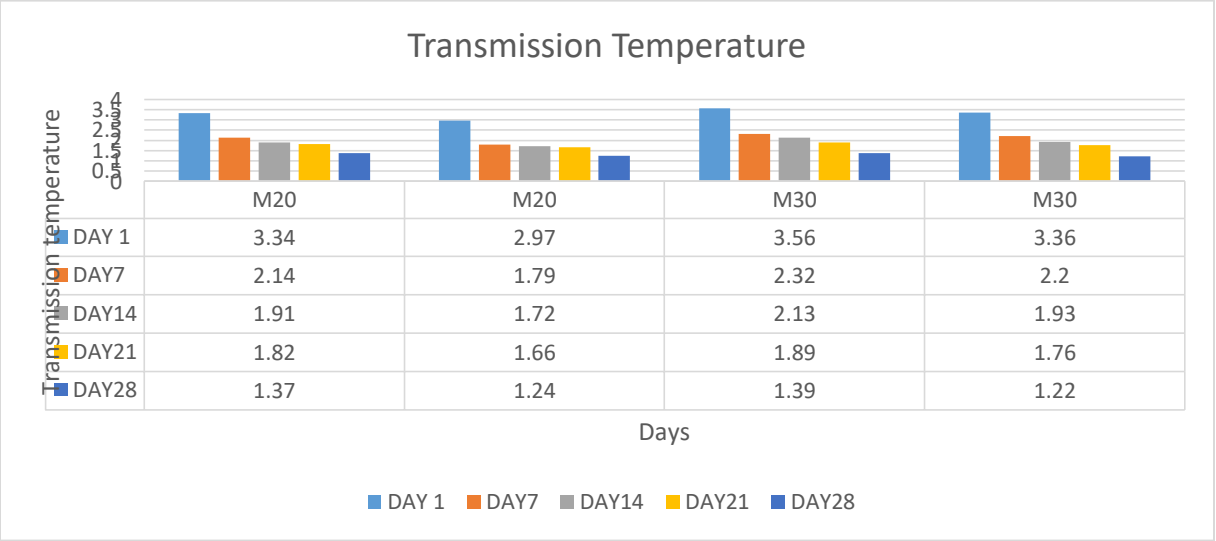
3. Results and Discussions



	M20	M20	M30	M30
DAY 1	2.18	2.41	3.19	3.32
DAY7	10.73	10.92	16.85	17.18
DAY14	13.13	13.67	21.72	21.94
DAY21	17.56	18.16	25.28	25.61
DAY28	19.71	20.13	27.72	28.07



	M20	M20	M30	M30
DAY 1	0.92	1.04	1.09	1.21
DAY7	4.06	4.17	5.83	6.15
DAY14	4.53	4.67	6.29	6.36
DAY21	5.08	5.21	7.23	7.33
DAY28	5.78	5.92	8.17	8.39



	M20	M20	M30	M30
DAY 1	3.34	2.97	3.56	3.36
DAY7	2.14	1.79	2.32	2.2
DAY14	1.91	1.72	2.13	1.93
DAY21	1.82	1.66	1.89	1.76
DAY28	1.37	1.24	1.39	1.22

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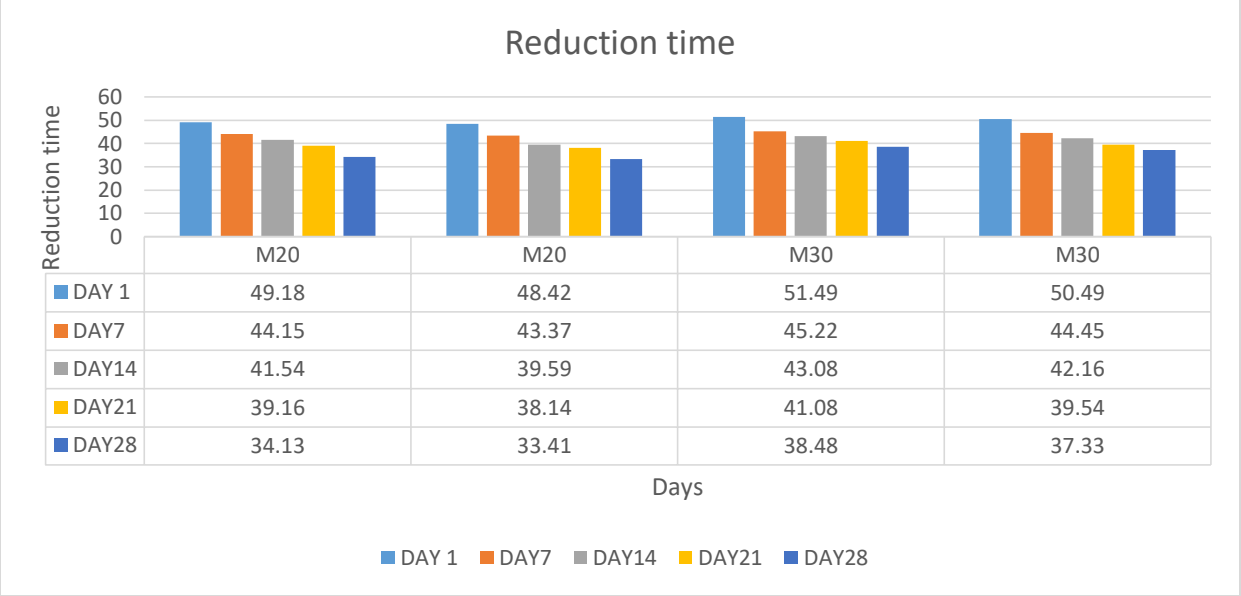

	M20	M20	M30	M30
DAY 1	49.18	48.42	51.49	50.49
DAY7	44.15	43.37	45.22	44.45
DAY14	41.54	39.59	43.08	42.16
DAY21	39.16	38.14	41.08	39.54
DAY28	34.13	33.41	38.48	37.33

4. Conclusions & Recommendations

From the fig (3) it can be observed the M20 grade and M30 grade concrete with clay soil aggregates concrete transmitted less temperature 1.37 0c and 1.39 0c respectively. This clearly states that approximately 10% of heat transmitting property has decreased. In fig (4) shows, time taken by each sample to reduce its temperature from 100 degree centigrade to 40 degree centigrade. Present study reveals that clay soil aggregate concrete cube takes very less time 33 min 41 sec and 37 min 33 sec compared to normal course aggregate concrete taking 34 min 13 sec and 38 min 48 sec for M20 and M30 grade respectively. That is approximately 1 min 30 sec faster. Hence it says the temperature liberating during exothermal reaction may be less in clay soil aggregates cubes.

Although fig [1] and fig [2] shows compressive strength and flexural strength of concrete cubes with clay soil aggregates used as fine aggregate and normal course aggregates cube. The values of results are not considerable because clay aggregates swells and shrinks drastically.
Hence, doing we can't use clay soil aggregates as fine aggregates for building or road construction but, it can be used in manufacture of tiles and crockeries manufactures where temperature holding capacity place a major role.

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