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EXPERIMENTAL INVESTIGATION OF M30 GRADE SELF COMPACTING CONCRETE BY USING TURRITELLA AND BENTONITE

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Abstract:

Self-compacting concrete, also referred to as self-consolidating concrete, is in a position to go with the flow and consolidate under its personal weight and is de-aerated almost definitely whilst flowing in the formwork. The goals of this lookup is blended effects of turritella and bentonite included in self compaction concrete in order to make bigger in strength and a higher bonding between combination and cement paste. SCC has an advantage over conventional concrete in that it can be easily placed without vibration or mechanical consolidation. Turritella and bentonite is used to replace cement in stepped concentration of 0 %, 5%, 10%, 15%, and used to gain characteristic compressive strength of M_{30} grade concrete mix and cured normal water and nitric acid solution (HNO3) in for different ages (7 days and 28 days) were determined. Nitric acid used for the curing of normal water in the concentration of 1% and 5%.This lookup is aimed to look at the degradation of self-compacting concrete (SCC) due to nitric acid assault particularly based totally on measurement of compressive energy loss. Trial mixes with the various water cement ratio, substitute percentage, extent of notable plasticizer and viscosity bettering agent, have been equipped and tested. The test results for acceptance characteristics of self-compacting concrete such as slump flow and T50cm, v-funnel, T5 minutes and L-box are presented.

***Keywords**: Bentonite, compressive strength test, nitric acid, super plasticizer, self-compacting concrete, turritella.*

I. INTRODUCTION

Self-compacting concrete (SCC) is a new kind of high-performance concrete (HPC) developed in Japan in 1986. The development of SCC has made casting of dense reinforcement and mass concrete convenient. Turritella and bentonite included in self compaction concrete in order to make bigger in strength and a higher bonding between combination and cement paste.

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Concrete is the most basic element for any kind of construction work. The main reasons for compacting any type of concrete are: To ensure maximum density by removal of any entrapped air. To ensure that the concrete used is in full contact with both the steel reinforcement and the form work. Concrete made of Portland are highly alkaline with pH values normally above 12.5 and are not easily attacked by acidic solutions. As the pH of the solution decreases the equilibrium in the cement matrix is being distributed and the hydrated cement compounds are specially altered by hydrolytic decomposition which leads to the severe degradation of the technical properties of the material.With the addition of Turritella and Bentonite weight density of concrete reduces by 72-75%. Thus, concrete with Turritella and Bentonite can be effectively used as light weight concrete. Thus, the use of Turritella and Bentonite in concrete leads to around 8-12% saving in material cost. So, the addition of Turritella and Bentonite in concrete helps in making an economical concrete. An experimental study on mechanical properties, such as compressive strength of self-compacting concrete (SCC) and the corresponding properties of self-compacting concrete were studied. The age at loading of the concretes for 7 and 28 days curing.

TURRITELLA is a genus of medium-sized sea snails with an operculum, marine gastropod mollusks in the family turritellidae. They have tightly coiled shells, whose overall shape is basically that of an elongated cone.

BENTONITE is absorbent swelling clay consisting mostly of montmorillonite, it usually forms from weathering of volcanic ash in seawater, which converts the volcanic glass present in the ash to clay minerals. As aswelling clay, bentonite has the ability to absorb large quantities of water, which increases its volume by up to a factor of eight.

TURRITELLA

BENTONITE

1. OBJECTIVES

The main objective is to obtain specific experimental data, to understand fresh and hardened properties of the self-compacting concrete and design M_{30} grade self-compacting concrete. The following are the important objectives of the self-compacting concrete. They are:

- To design and produce mix proportions for self-compacting concrete (SCC).
- To obtain and compare the physical and chemical properties of self-compacting concrete.
- To evaluate the physical properties and chemical properties of turritilla and bentonite.

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- To determine the various tests such as slump flow and T50cm, L-box, U- box, T5 minutes and V-funnel etc.
- In this project, admixtures such as turritila and bentonite are used the replacement of cement because of gain the strength of concrete.

2. MIX DESIGN

- In this project, for developing rich concrete mix, it is important to select proper ingredients, evaluate their properties and understand the interaction among different materials for optimum usage.
- The materials used for this investigation is the same as that used for the normal concrete mix such as cement, fine aggregate (FA), coarse aggregate (CA) and water. Along with these materials turritella and bentonite are used as a cement replacement material and super plasticizer as a chemical admixture.
- In this experimental work, the typical size of cube150mm×150mm×150mm is used. The mix design (procedure) of concrete is done according to Indian standard guidelines for M_{30} grade. Based upon the quantities of component of the mixes, the numbers of turritella and bentonite for 0%, 5%, 10%, 15%, replacement by weight of sand and weight of cement is estimated.

3. TESTS AND RESULTS

Table 4.1 Mix Proportion

Type of concrete	**cement (kg/m^3)**	**Fine aggregate (kg/m^3)**	**Coarse aggregate (kg/m^3)**	**Water (kg/m^3)**	**Super plasticizer**
SCC	440	503.04	739.68	220	0.2%
	1.00	1.14	1.68	0.50	0.2%

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Table 4.2 Workability Methods

	Slump flow (mm)	T50 (sec)	V-funnel (sec)	T5 minutes (sec)	L-Box
Test results	705	3.8	9	11	0.95

Table 4.3 Compressive strength results for cubes cured in water after 7 days

% of Turritella and Bentonite	Load (T1)	Load (T2)	Area(mm2)	Average load	Compressive strength (N\mm2)
0%	400	380	22500	390	16.81
5%	320	360	22500	340	15.1
10%	320	280	22500	300	13.3
15%	318	279	22500	297	13.2

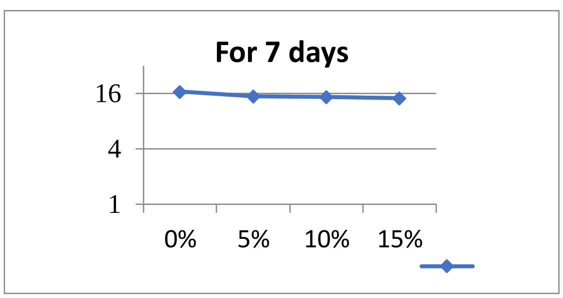

Figure 4.1: Graphical Representation of Compressive Strength after 7days

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Table 4.4 Compressive strength results for cubes cured in water after 28 days

% of Turritella and Bentonite	Load (T1)	Load (T2)	Area(mm2)	Average load	Compressive strength (N\mm^2)
0%	880	900	22500	890	39.10
5%	680	720	22500	700	31.12
10%	610	650	22500	650	28.65
15%	580	620	22500	600	26.22

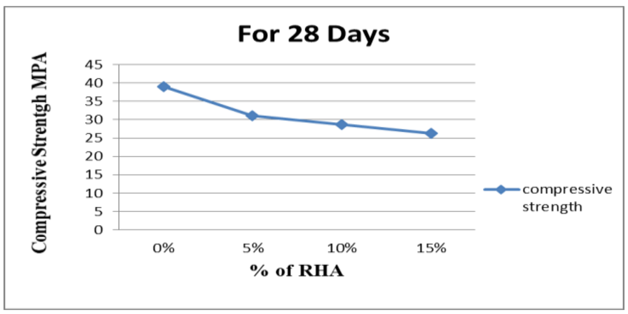

Figure 4.2: Graphical Representation of Compressive Strength after 28 days

Table 4.5 Compressive strength results for cubes exposed to 1% by volume of HNO3 solution after 28 days

% of Turritella and Bentonite	Load(T1)	Load(T2)	Area(mm2)	Average load	Compressive strength (N\mm2)
0%	700	740	22500	720	32.15
5%	630	670	22500	650	28.15
10%	580	620	22500	600	26.66
15%	520	580	22500	550	24.66

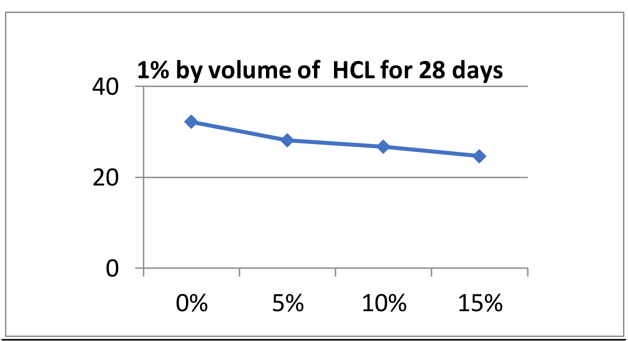

Figure 4.3: Graphical Representation of Compressive Strength exposed 1% by volume HNO3 solution

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Table 4.6 Compressive strength results for cubes exposed to 5% by volume of nitric acid solution after 28 days

% of Turritella and Bentonite	Load(T1)	Load(T2)	Area(mm2)	Average load	Compressive strength (N\mm2)
0%	500	600	22500	550	24.4
5%	400	500	22500	450	20.67
10%	380	420	22500	400	18.20
15%	340	420	22500	380	16.11

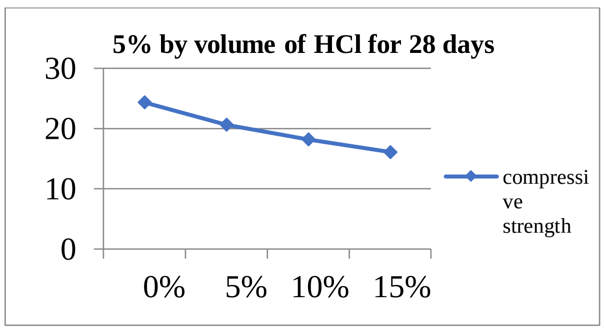

Figure 6.4: Graphical Representation of Compressive Strength exposed 5% by volume nitric acid solution

Fig. L-Box Test

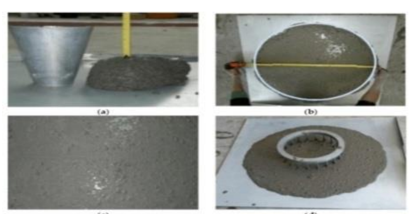

Fig. Slump Flow Test

Fig. V-Funnel Test

Fig. Compressive strength of concrete

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4. CONCLUSIONS

From the experimental investigation the following conclusions are drawn:

- The compressive strength of concrete (with 0%, 5%, 10%, and 15%) weight replacement of cement with turritella and bentonite cured in normal water for 7days and 28 days have reached the target mean strength.
- Comparative study on turritella and bentonite concrete with various replacement percentage of turritella and bentonite showed that, and shows better strength than other replacements due to high pozzolanic activity.
- From results m30 grade turritella and bentonite concrete for nitric acid solution exposure in 28 days, the various replacement showed better compressive strengths.
- The compressive strength decreased with the increase in concentrations of nitric acid in curing water.
- At various replacements of turritella and bentonite gives maximum strengths and shows good resistance to hydrochloric attack.
- Utilization of turritella and bentonite its application are used for the development of the construction industry, material science.
- It is the possible alternative solution ofsafe disposal of turritella and bentonite
- Turritella and bentonite becomes more economical without compromising concrete strength than the standard concrete. It becomes technically and economically feasible and viable.
- To compare graphs and tables values of normal water curing and nitric acid solution curing and attack the hydrochloric acid solution then decreased the compressive strength of the self compacting concrete.
- The workability test results of slump flow and t50cm, v- funnel, l- box, t5 minutes value ranges of self compacting concrete are presented.
- To evaluate the test results of compressive strength of self compacting concrete with turritella and bentonite to nitric acid solution after 7 days and 28 days.

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