Experimental Study on Strengthening of Concret by Replacing 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. It is cohesive enough to fill the spaces of almost any size and structure barring segregation or bleeding. This makes SCC in particular really helpful at any place putting is difficult, such as in heavily-reinforced concrete contributors or in complex work forms. 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. The properties of SCC have been studied in many researches due to its importance and ability to solve the problems of concrete mix Turritella and bentonite is used to replace cement in stepped concentration of 0 %, 5%, 10%, 15%, and used to gain characteristic compressive strength of M30 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%. Thes 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. The outcomes of excessive extent turritella and bentonite at 0% to 15% cement substitute degrees on the extent of degradation to nitric acid will be assessed in this study.

***Index Terms*— Bentonite, Compressive strength, 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. Fresh self-compacting concrete SCC flows into formwork and around obstructions under its own weight to fill it completely and self-compact (without any need for vibration), without any segregation and blocking. SCC mixes generally have a much higher content of fine fillers, including cement, and produce excessively high compressive strength concrete, which restricts its field of application to special concrete only. Self-compacting concrete has been successfully used in Japan, Denmark, France, U.K., etc. It is widely been accepted because of its enhanced properties also it reduces noise pollution, saves time, labour and energy. Cement used in concrete is a mixture of complex compounds. Cement is a major industrial commodity that is manufactured commercially in over 120 countries. Mixed with aggregates and water, cement forms the ubiquitous concrete which is used in the construction of buildings, roads, bridges and other structures. In countries, even where wood is in good supply, concrete also features heavily in the construction of residential buildings. Production of concrete using Portland cement is popular all over the world. This is due to mainly low cost of materials and construction for concrete structures as well as low cost of maintenance. But high amount of energy is required for manufacturing of cement which emits carbon dioxide (CO2) which is very harmful for the environment In order to minimize this problem we use the concept of supplementary cementitious material. Some of agricultural and industrial waste ash which was fulfilled the criteria as supplementary cementitious materials. With the addition of turritella and bentonite weight density of concrete reduces by 72- 75%. Thus, the use of turritella and bentonite in concrete leads to around 8-12% saving in material cost.

A. Objectives

The investigation has been carried out with the following objectives.

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

3. To evaluate the physical properties and chemical properties of turritella and bentonite.

RESEARCH SIGNIFICANCE

The most common material used to prepare concrete is natural sand. Due to excessive river sand mining and large-scale resource depletion, there have been major issues with its availability, cost, and impact on the environment related to its continuous consumption over the past ten years. The concrete industry currently needs an alternative to river sand. The material's capacity to meet strength and durability standards demonstrates its suitability as a substitute for fine aggregates in concrete. One such substance that has been discovered to be suitable for use as a sand replacement in concrete is red soil. A percentage of red soil is used in an experiment to partially replace fine aggregate to investigate the qualities of concrete. In these mixed proportions, workability, and mechanical properties are further studied.

II. MATERIALS AND METHODOLOGY

1. Cement:

A binder, known as cement, is used to set, harden, and remain in other materials, binding them together. Cement, sand, and gravel combine to form concrete. OPC 53 grade cement was used throughout the project work.

2. Fine aggregate:

In this study, manufactured sand, which passes through a 4.75 mm sieve, is used as the fine aggregate. The samples are tested according to IS 2386.

3. Coarse aggregate:

The coarse aggregate, which has a maximum size of 12.5 mm and is retained on an IS 4.75 sieve, was chosen based on shape per IS 2386 (Part I) 1963. The aggregate's surface texture properties are classified using 383–1970. The nominal size of 20 mm coarse aggregate is used throughout the project work.

4. Turritella and Bentonite

Turritella and Bentonite is obtained by burning turritella and bentonite in a controlled manner without causing environmental pollution. When properly burnt, it has high Si O2 content and can be used as a concrete admixture Turritella and Bentonite exhibits high pozzolanic characteristics and contributes to high strength and high impermeability of concrete. The chemical composition of turritella and bentonite is found to vary from one sample to another due to the differences in the type of paddy, crop year, climate and geographical conditionsWater:

5. Water

plays a crucial role in both the mixing and curing processes of concrete, ensuring its strength and durability.

6. Nitric acid (HNO3)

Nitric acid or muriatic acid is a colorless inorganic chemical system with the formula H2O-HNO3. Nitric acid has a distinctive pungent smell. It is classified as strongly acidic and can attack the skin over a wide composition range, since the hydrogen chloride completely dissociates in an aqueous solution. Nitric acid is the simplest chlorine-based acid system containing water. It is a solution of hydrogen chloride and water, and a variety of other chemical species, including hydronium and chloride ions. It is a naturally-occurring component of the gastric acid produced in the digestive systems of most animal species, including humans.

7. Super Plasticizer

Conplast sp 430 in liquid structure with 65% free water is used. High range water reducing admixture called as super plasticizers are used for improving the flow or workability for decreased water-cement ratio without sacrifice for compressive strength. These admixtures when they disperse in cement agglomerates significantly decrease a viscosity of the paste by forming a thin film around the cement particles.

III. EXPERIMENTAL INVESTIGATION

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 M30 grade. Based upon the quantities of component of the mixes, the numbers of SCBA and turritella and bentonite for 0%, 5%, 10%, 15%, replacement by weight of sand and weight of cement is estimated.

Figure(a): nitric acid (HNO3)

Figure(b): Fine Aggregate

A. Mix design

A concrete mix design was carried out to identify the correct amounts of cement, sand, and coarse particles required for casting concrete with a target compressive strength of 3000 psi. Table II displays the findings of the material proportions of cement (C), fine aggregate (FA), coarse aggregate (CA), and the water-cement ratio (W/C). The slump value was also considered satisfactory.

B. Casting and curing

Figure(c): Casting the concrete cubes

C. For the compressive strength test, 12 cubes were cast as shown in Fig. 3. Throughout the work, a suitable mix proportion was maintained. After 24 hours of casting, the cubes have been placed in water for the proper curing times (Fig. 4).

Figure(d): Curing the cubes for 7, 14, & 28 days

Figure(e): Cubes tested under compressive testing machine.

IV. RESULTS AND DISCUSSION

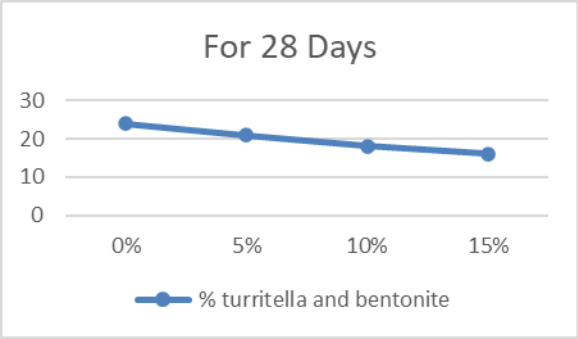
A. Compressive strength of concrete cubes

A total of 150 mm-sized 12 specimens were cast. After a curing period of 7, 14, and 28 days tested respectively, by using a calibrated compression testing

machine of 2000 KN capacity. The obtained results are tabulated below.

Grade of concrete	% of red mud used	7 days	14 days	28 days
M-30	0%	16.81	25.51	39.10
	5%	15.1	24.21	31.12
	10%	13.1	25.47	28.65
	15%	13.2	24.01	26.22

TABLE 1.3 Compressive strength of concrete cubes for 7, 14, & 28 days



1.1: Comparing compressive strength for concrete of 28 dayscx

The compressive strength of concrete is increased by 10% by replacement fine aggregate with red soil, after which it is reduced.

CONCLUSION

The compressive strength of concrete (with 0%, 5%, 10%, 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 rice husk ash 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 nitric 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 of safe 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.

REFERENCES

[1] Thirumalai Raja Krishnasamy, MurthiPalanisamy, Bagasse ash and rice husk ash as cement replacement in self- [1] Thirumalai Raja Krishnasamy, Murthi Palanisamy, Bagasse ash and rice husk ash as cement replacement in self-compacting concrete in studies conducted to determine the workability of concrete, the bagasse ash and rice husk ash were added as a partial replacement for cement. Trial mixes with the varying water cement ratio, replacement percentage, quantity of super plasticizer and viscosity modifying agent, were prepared and tested. The results were used asthe basis for defining three optimum cement replacement mix proportions, which comply with the self-compacting concrete requirements for several structural applications. .

[2] Anil Kumar Suman, Anil Kumar Saxena, T. R. Arora (2015), “Assessment of Concrete Strength using Partial Replacement of Cement for Rise Husk Ash”, International Journal of Soft Computing and Engineering (IJSCE), ISSN: 2231-2307, Volume-4, Issue-6, January 2015.

[3] Ch.Sivanarayana, K Pratyusha, P V Rambabu, G V Ramarao (2014), “A Study on Sulphuric Acid Attack on Concrete with Rice Husk Ash as a Partial Replacement of Cement”, International Journal of Engineering Research and Development, e-ISSN: 2278-067X, pISSN: 2278-800X, Volume 10, Issue 4, pp.43-49, April 2014.

[4] Deepa G Nair, K. Sivaraman and SJob Thomas, (2013), “Properties of Rice Husk Ash (RHA) - High strength Concrete”, American Journal of Engineering Research (AJER) e-ISSN: 2320-0847, pISSN: 2320-0936, Volume-3, pp-14-19.

[5] D. Siva Prasad and Dr. A. Rama Krishna (2011), “Production and Mechanical Properties ofA356.2 /RHAComposites”,

InternationalJournal of Advanced Science and Technology Vol. 33, August, 2011.

[6] Ettu L.O, Ajoku C.A, Nwachukwu K.C, Awodiji C.T.G, Eziefula U.G (2013), "Strength variation of OPC-rice husk ash composites with percentage rice husk ash", InternationalJournal of Applied Sciences and Engineering Research, ISSN 2277-9442, Vol. 2, Issue 4; 2013. 66

[7] GhassanAboodHabeeb, Hilmi Bin Mahmud, (2010), "Study on Properties of Rice Husk Ash and Its Use as Cement Replacement Material", Material Research, March 21, 2010; 13(2): 185-190.

[8] JosephDavidovits (1994), "Global Warming Impact on the Cement and Aggregate Industries", Published in World Resource Review, Vol. 6, No. 2, pp. 263- 278, 1994.

[9] K. Gurunaathan and G. S. Thirugnanam (2014), "Effect of mineral admixtures on durability properties of concrete", International Journal of Advance Structures and Geotechnical Engineering, ISSN 2319-5347, Vol. 03, No.01, January 2014.

[10] Obilade, I.O (2014), "Use of Rice Husk Ash as Partial Replacement for Cement in Concrete" International Journal of Engineering and Applied Sciences, ISSN 2305- 8269, Vol. 5, No. 4, Sept. 2014..

[11] S. D. Nagrale, Dr. HemantHajare, Pankaj R. Modak, (2012), "Utilization Of Rice Husk Ash", International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622, Vol. 2, Issue 4, July-August 2012s.

[12] Cordeiro, G., Toledo, R., Tavares, L., Fairbairn, E.: Ultrafine grinding ofsugar cane bagasse ash for application as pozzolanic admixture in concrete, Cement and Concrete Research.

[13] Ganesan, K., Rajagopal, K., Thangavel, K.: Evaluation of bagasse ash as supplementary cementitious material, Cement and concrete composites, 29 (2007).

[14] Memon, S., Shaikh, M., Akbar, H.: Utilization of rice husk ash as viscosity modifying agent in self-compacting concrete, Construction and building materials, 25 (2011).

[15] Sadrmomtazi, A., Barzegar, A.: Assessment of the effect of NanoSiO2 on physical and mechanical properties of self-compacting concrete containing rice husk ash, Second International Conference on Sustainable Construction Materials and Technologies, UniversitaPolitecnicadelle Marche, Ancona, 2010