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A Review- Utilization of Plastic waste and Alccofine in Self-Compacting Concrete

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Abstract: *Self-compacting concrete (SCC) is concrete which flows under its own weight through all shapes and obstruction and does not need vibration for compaction, this type of concrete does not required compaction and it saves time, labor and energy. self-compacting concrete can be considered as the greatest technical advancement and most revolutionary development in concrete technology over the years. this paper explains the utilization of plastic waste and Alccofine for enhancing the durability and workability of self-compacting concrete, Alccofine as a partial replacement of cement and Plastic waste from PET fibers as a partial replacement of sand, in this investigation it's found to be very useful in the modification properties of self- compacting concrete and it enhance the durability and workability of self-compacting concrete*.

Key Words*: *Self-compacting concrete (SCC), Alccofine, plastic waste, durability, workability

1. INTRODUCTION

Self-compacting concrete (SCC) was first developed in Japan around the year 1980, it was developed to overcome deficiency of skilled manpower and problems of placing and compacting congested civil engineering structures.

Cement-based materials are among the most important construction materials, and it is most likely that they will continue to have the same importance in the future. However, these construction and engineering materials must meet new and higher demands. When facing issues of productivity, economy, quality and environment, they have to compete with other construction materials such as plastic, steel and wood. One direction in this evolution is towards self-compacting concrete (SCC), a modified product that, without additional compaction energy, flows and consolidates under the influence of its own weight. The use of SCC offers a more industrialized production. Not only will it reduce the unhealthy tasks for workers, it can also reduce the technical costs of in situ cast concrete constructions, due to improved casting cycle, quality, durability, surface finish and reliability of concrete structures and eliminating some of the potential for human error. However, SCC is a sensitive mix, strongly dependent on the composition and the characteristics of its constituents. It has to possess the incompatible properties of high flow ability together with high segregation resistance. This balance is made possible by the dispersing effect of high-range water-reducing admixture (superplasticizer) combined with cohesiveness produced by a high concentration of fine particles in additional filler material. To produce SCC, the major work involves designing an appropriate mix proportion and evaluating the properties of the concrete thus obtained. In practice, SCC in its fresh state shows high fluidity, self-compacting ability and segregation resistance, all of which contribute to reducing the risk of honey combing of concrete (Su et al., 2001). With these good properties, the SCC produced can greatly improve the reliability and durability of the reinforced concrete structures.

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2. LITERATURE REVIEW

Dr.VaishaliGVijaya G.S, Ghorpade (2016), this paper deals with flow and strength characteristic such as compressive strength, split tensile strength, flexural strength and impact strength of SCC with various percentage of waste plastic fibers and GGBS, the result indicated that the compressive strength, split tensile strength and flexural strength was improved proportionally with the addition of waste plastic fibers up to 1.0% by weight of cement and then decreased. Dr.H.SudarsanaRao (2017), this paper outlined laboratory study on chloride resistance of waste plastic fibers reinforced SCC. Self-compacting concrete mixes with various percentage of waste plastic fibers. From the test result it was observed that maximum compressive strength was achieved for 1% of plastic fibers. SanjaySharma, Jagjeet Singh, Ishan Tank (2016), this study presents the effect of incorporating Alccofine and crimped steel fibers on the rheological and mechanical properties of Self-compacting concrete, fibers were added in the proportion of 0.5% up to 1.5% and were compared with the controlled mix. There was significant increase in the splitting tensile strength and flexural strength of the concrete mix design. Vikram.K .Shadi, M.A. Banarase (2015), in this paper the effect of Alccofine on properties of Self-compacting concrete has been studied, the aim of this study was to evaluate the high performance of concrete containing supplementary cementations materials such as Alccofine. It was found that the result of alccofine material increase the strength to a large extent. If the percentage of Alccofine increase beyond that level it acts as a filler material and yields good workability to the concrete. And it was absorbed that 10% Alccofine is optimum percentage for replacement of cement. Dr.Sinha,DeepaA, Sabuwala Hasan K: the aim of this study was to evaluate the performance of (SCC) containing supplementary cementitious materials such as fly-ash and Alccofine, this study investigates the performance of concrete mixtures in term of compressive, flexural strength, Result showed that concrete incorporating Alccofine and fly ash have higher compressive strength and Alccofine enhance the durability of concrete and reduced the chloride diffusion.

3. MATERIALS & METHODOLOGY

The materials used in Self-compacting concrete are same as conventional concrete except that an excess of fine materials and super plasticizer admixtures used. For this study Plastic waste and Alccofine are used as partial replacement of fine aggregate and cement.

3.1 Cement

All cement confirming to IS: 12269-1987 can be used for production of SCC, for this study Ordinary Portland cement grade 43 used.

3.2 Fine Aggregate

Fine aggregate confirming to IS 383-1970 used with maximum size of 4mm for production of SCC.

3.3 Coarse aggregate

Coarse aggregate confirming to IS: 383-1970 are appropriate for the production of SCC, its locally available crushed blue granite stones confirming to graded aggregate of nominal size 12.5mm as per code and maximum size of 16mm.

3.4 Plastic waste (PET Fibers)

Two different plastic waste sizes are used; Fine plastic waste(FPW) passing through 1mm sieve, and coarse plastic waste(CPW) retaining on 1mm sieve and passing from 4mm sieve are mixed to obtain a new mix plastic waste.

3.5 Alccofine 1203

Alccofine is a specially processed product based on slag of high glass content with high reactivity obtained through the process of controlled granulation. Alccofine 1203 confirming to ASTM C989-99 is used.

Table1: Chemical properties of Alccofine[15]

C_aO	SO_3	SiO_2	Fe_2O_3	Al_2O_3	MgO
61-64%	2-2.4%	21-23%	3.8-4.4%	5-5.6%	0.8-1.4%

3.6 Super plasticizer Admixture

Super plasticizer admixture or high range water reducer is the most important admixture with a water reduction greater than 20% for SCC. For this study polycarboxylic ether (Glenium B233) is used to improve the workability of mixes.

Table2: properties of Glenium B233[16]

Aspects	Light brown liquid
Relative density	1.09±0.01 at 25ºc
PH	>6
Chloridion content	<0.2%

Mix proportions

The mix design for Self-Compacting Concrete can be done according to the EFNARC specifications and guidelines, according to EFNARC there are different methods for Mix proportion in SCC, the easiest method is known as Nan-Su method, with Nan-Su method SCC can get the same homogeneity and uniformity in all mixes. Mix design often use volume as a key design parameter because of the importance of the need to over fill the voids between the aggregate particles.

Mix design procedure by Nan-Su method

It is considered to be the very simple and easy method and therefore is utilized for designing SCC mix. method The

principal consideration of the proposed method is to fill the paste of binders into voids of the aggregate framework piled loosely. The loose unit weight of the aggregate is according to the shoveling procedure of ASTM C29, except discharging the aggregate at a height of 30 cm above to the top of the measure. The procedures of the proposed mix design method can be summarized in the following steps. Step 1: Calculation of coarse and fine aggregate contents. Step 2: Calculation of cement content. Step 3: Calculation of mixing water content required by cement. Step 4: Calculation of Waste Plastic and Alccofine 1203 contents. Step 5: Calculation of mixing water content needed in SCC. Step 6: Calculation of SP dosage. Step 7: Adjustment of mixing water content needed in SCC. Step 8: Trial mixes and tests on SCC properties. Step 9: Adjustment of mix proportions.

4. RESULTS & DISCUSSIONS

The test results which are shows in table 3 and table 4 and figures, are the optimum results of Utilization of Alccofine and plastic waste in Self-compacting concrete. As per literature reviews and tables The optimum results achieved by 10% Alccofine and 1% plastic waste as a partial replacement of cement and fine aggregate in Self compacting concrete.

So Plastic waste and Alccofine can be used in production of Self compacting concrete for reducing the total cost and for enhancing the workability and durability of SCC.

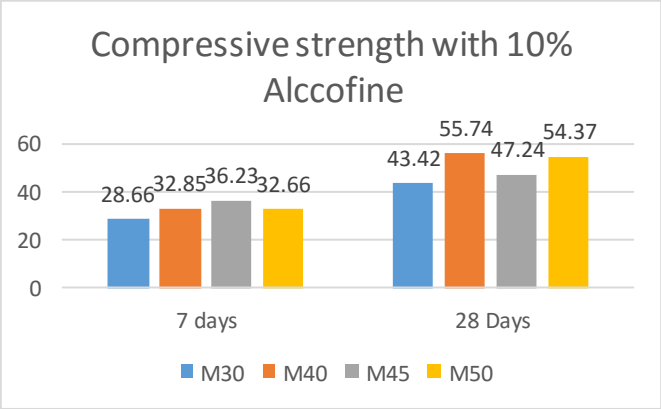
5. CONCLUSION

This paper deals with use of plastic waste and Alccofine in mix proportion of Self-compacted concrete(SCC) with various percentages.

- As from results it observed that 10% of Alccofine as a partial replacement of cement has best result in strength both (compressive strength and split tensile strength) and it increase durability of Self-compacted concrete.
- Plastic waste with 1% has best result in proportion of Self compacted concrete as a partial replacement of fine aggregate.
- This reviewed literature broadly signifies the utilization of Plastic waste and Alccofine has been proved that they can be used in production of Self compacted concrete for reducing the total cost and pollution from concrete.
- Plastic waste and Alccofine enhance the workability and durability of Self-compacting concrete for sustainable construction.

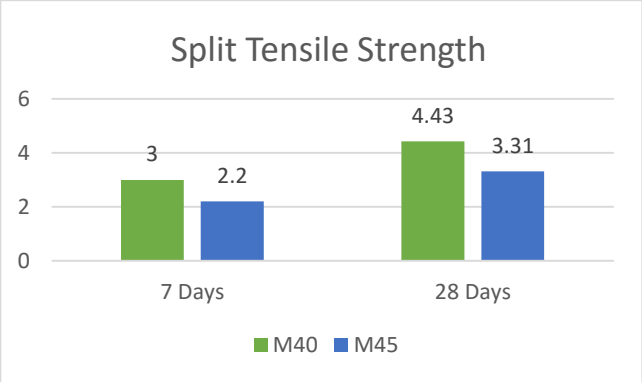
Use of plastic waste in Self-compacting concrete helps to keep clean the environment for waste disposal and to serve an economic purpose for having a green and eco-friendly Self-compacted concrete

Figure1: Results of Compressive strength with 10%Alccofine



M30-M.S Pawer, A.C Saoji , M40-Subhan Ahmad, Arshad Umar ,M45-R.Divakar ,M50-Dr.Sinha

Figure2: Results of Split tensile strength



M40- Subhan Ahmad, M45- R.Divakr

6. REFERENCES

[1]. Hardik Upadhyay, Pankaj Shah, Elizabeth George, Testing And Mix Design Method Of Self –Compacting Concrete, National Conference On Recent Trends In Engineering & Technology, May 2011 P

[2]. Iliana Rodriguez Viacava, Antonio Aguado Dea Cea, Gemma Rodriguez De Sensale, "Self Compacting Concrete Of Medium Concrete Characteristics Strength." Construction and Building Materials 30(2012) 776-782.

[3]. Nan, Su; Kung –Chung, H; His – Wen, C; "A Simple Mix Design Method For Self Compacting Concrete." Cement and Concrete Research 31(2001) P.P. 1799-1807

[4]. Sahmaran, M; Yaman , O.I.; Tokyoy, M. (2009), " Transport And Mechanical Properties Of Self Consolidating Concrete With High Volume Of Fly Ash", Cement And Concrete Composites Vol : 31, Pp 99- 106.

[5]. Zoran Jure Grdic., Gordana A.Toplicic-Curcic. Iva M.

[6]. ACI code 211.4R-08: "Guide or selecting proportions for HSC using Portland cement and other cementitious material."

[7]. Mallikarjuna Reddy V, Seshagiri Rao M V.(2013) ." Effect of W/C Ratio on Workability and Mechanical Properties of High Strength Self Compacting Concrete (M70 Grade)" International Journal of Engineering Research and Development.

[8]. M.J. Shannag (2000)." High strength concrete containing natural pozzolan and silica fume". Elsevier Science Ltd, Cement & Concrete Composites 22.

[9]. C. Freeda Christya and D Tensing. (April 2010)." Effect of Class-F Fly Ash as Partial Replacement with Cement and Fine Aggregate in Mortar" Indian Journal of Engineering & Materials Sciences, Vol. 17, April 2010, pp. 140-144.

[10]. IS 10262: 2009 "Indian standard concrete mix proportioning guidelines" (First Revision). Bureau of Indian Standard New Delhi.

[11]. IS 383, "Specifications for Coarse and Fine Aggregates from Natural Source of Concrete," Bureau of Indian Standard New Delhi,1982.

[12]. IS: 516-1959, Edition 1.2 (1991-07), "Indian Standard for Methods of test for strength of concrete." Bureau of Indian Standard New Delhi.

[13]. Izhar Ahmed and S.S.Jamkar. (Nov/Dec 2012)." Effects of Fly Ash on Properties of Concrete as Per Is: 10262-2009" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Volume 4, Issue 2 , PP 01-05.

[14]. M.Z Shaikh and S.S. Jamkar . (August-2015)." Experimental investigation on effect of mineral admixtures on high performance concrete with various w/b ratios." International Journal of Research in Engineering and Technology.pp169-177.

[15]. M.C. Nataraja and Lelin Das. September 2010. "Concrete mix proportioning as per IS: 10262-2009 Comparison with IS: 10262-1982 and ACI 211.1-91." the Indian concrete journal.

[16] Yatin patel, Dr. B.K.. Shah, „Study on durability of high performance Concrete with alccofine and fly ash, (1998). IJSRD Vol.1 Issue (2013)

[17]. Siddharth P Upadhyay Prof. M.A.Jamnu "Effect on compressive strength of high performance concrete incorporating alccofine and fly ash" ISSN , Volume 2 Issue 2

[18]. Saurabh Gupta, Dr. Sanjay Sharma, Er. Devinder Sharma3 "A review on alccofine a supplementary cementitous material, IJMMTER Vol. 3

[19] Rajesh kumar , Dilip k. Singha "An experimental study on the mechanical properties ofalccofine based high grade concrete" International Journal of Multidisciplinary Research and Development

[20] Ansari U.S, Chaudhri I.M, Ghuge N.P, Phatangre R.R. "High Performance Concrete with Partial Replacement of Cement by ALCCOFINE & Fly Ash"

[21] Deval Soni ** Suhasini Kulkarni *** Vilin Parekh "Experimental Study on High- Performance Concrete, with Mixing of Alccofine and Flyash" Vol.: 3 | Issue: 4 | May 2013 ISSN - 2250-1991

[22] M.S. Pawar, A.C. Saoji, "Effect of Alccofine on Self Compacting Concrete" The International Journal Of Engineering And Science (IJES), Volume 2 ||Issue|| 6 ||Pages|| 05-09||2013|| ISSN(e): 2319 – 1813 ISSN(p): 2319 – 1805

[23] Saurav, Ashok Kumar Gupta, "Experimental study of strength relationship of concrete cube and concrete cylinder using ultrafine slag Alccofine" International Journal of Scientific & Engineering Research, Volume 5, Issue 5, May-2014 102 ISSN 2229-5518

[24] Abhijitsinh Parmar, Dhaval M Patel, "Experimental Study on High Performance Concrete by Using Alccofine and Fly Ash - Hard Concrete Properties" International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 12, December – 2013 IJERT (IJERT) ISSN: 2278- 018