

Use of Alccofine and Fibres in Making Concrete- A Review

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Abstract— Supplementary cementitious materials (Mineral Admixtures) has made revolution in construction industry Alccofine is a micro fine powder which is used in making high performance concrete. The aim of this paper is to highlight the usage and importance of Alccofine together with fibers in making concrete. Both materials improved mechanical properties and durability properties in different types of concrete.

Keywords—Alccofine, construction industry, fibres, durability propertiess

INTRODUCTION

The framework of building development is as old as historical background when numerous materials were used for establishment. Cement is one of the maximum used construction elements, nearly about 13 tonnes which is average usage in current scenario. Humankind uses enormous amount of things after cement, so prime used element is considered as cement. Characteristics of cement can be under many categories. Material which converts into solid and turns out to be a material, which undergoes many sort of functions like prevailing strength in desired component. Portland cement converts into solid form and follows a theory, which is blended with other materials including water. Concrete is having a utilization to be in scene of development which is considered as to be either driven by water else driven in form of non-pressure. Many materials are there which can withstand the quality of cement and can be used to receive the top-notch cement. Some forceful admixtures are used in initial setting for long-term strengths, which can result into betterment of bonds. This type of altering property of cement will help the overall performance, further; it can also be beneficial for massive construction. Cement permits to form a solid part even in conditions like submerged and over dried environments too which shows the possibility of generating various concepts of cement technologies. For further advancement in research and development of numerous material which can help composition of concrete to deliver more performance in terms of mechanical and durability property. Usually many types of admixture now a days are available from chemical to mineral admixtures, concrete has now various option which can give benefits in different types of construction. As research and developments helps to make cement less vulnerable against many environmental agents which further helps in improving service life, early strength, volume stability, good compaction without segregation and long term mechanical properties. The different ingredients used in investigations are 1) Cement 2) Fine Aggregates 3) Coarse Aggregates 4) Water 5) Mineral Admixture and 6) Chemical Admixture

Mangat and Gursamy [1] presented some results regarding marine concrete in which steel fibre has been used with chloride diffusion which holds discussion about a specific mix proportion of concrete, which was mixed with different type of steel fibres. Tests like marine splash, tidal zone exposure has been setup so that chlorine concentrations can be determine at a depth value of concrete, and furthermore influences on small as well as wide cracks are monitored. Article concluded that steel fibres are good source to make insignificant effects for chloride penetrations and with steel fibres concrete gets good resistance against tidal waves and exposure of moist environment. Steel fibres have pointless influence on concrete regarding chloride penetration. Cubes which were cured on beach take cycle of 150 tids in 95 days of exposure. Due to high cement constituent 590 kg/m^3 and water ratio of 0.4 do not present a barrier for penetration of chloride into concrete specimens. After the values of 150, 300 and 2000 marine spray cycles were 6.13×10^{-8} , 3.90×10^{-8} and $2.81 \times 10^{-8} \text{ cm}^2/\text{sec}$. Steel fibres shows anisotropic behaviour due to fibre orientation in compaction. This type of anisotropic behaviour can exhale good effects by maintaining compaction procedure into direction for relative stress fields.

Reinhardt and Kormeling [2] showed the effect of strain rate and lower temperature on mechanical properties of steel fibre on compare with plain concrete. On strain rates of 1.5 and 3 percent 80 specimens were tested. Many properties also enhanced at low temperatures and also applies theory of kinetics to plain concrete to understand temperature and strain effects. It generates an idea where concrete behaviour during tensile loads which were tested at 20°C and -170°C. Large differences were noticed at -170°C and additional to that free cracks width is 12.5 mm, according to half fibre length used which results into calculation of steel fibres in desired cross section is not equal for showing complete stress in deformation curve.

Rossi et al. [3] developed new material termed as steel fibre reinforced concrete to verify advantages on existing elements in concrete. The work shows about interaction and effects generated by steel fibre towards concrete, furthermore the role played by steel fibres in filling macro cracks is being observed. Usage of steel fibres shows the conception usage according to micro and macro cracks of concrete. The results are based on plain concrete, SFRC DCB with 0.05%, 0.1% and 1% reinforcement ratio. Action of steel fibres during damage process of concrete leads to better conception of their usage. Additional steel fibres give increment to the critical load to start the macro cracking by 11%. Addition of 1% volume of steel fibres can be a good replacement of 0.15% of steel reinforcement.

Lim et al. [4] investigated behaviour of concrete beams under mechanical and fibre reinforcement testing. Testing includes the steel fibre volume fraction and stirrups ratio on desired shear reinforcements. Whole study includes identifying the shear characteristics of reinforced concrete beams with steel fibres. Present experimental program consisting three types of reinforced concrete beams having similar rectangular cross section of 100 × 180 mm. Span length is 1300 mm and on shear side is 400 mm. Nine beams were tested to find out effect of fibre reinforcement on mechanical property of concrete. There is increment of 25% when fibres are into concrete by volume. Numerous tests are carried out like mechanical and durability properties plus behaviour of beams with steel fibres.

Ding et al. [5] presented some comparative results from properties of steel fibre reinforced concrete at initial stage, and overall aims at SRFC applications for tunnel and other underground constructions. Various testing of beam and panel bending test are done on additional of steel fibre in concrete to improve ductility as well as toughness at 28 days and also on initial stages. Impact and bending of several beams and panels for compression and extensive experiments. Which furtherly concludes that SRFS two dimensional reinforces the shear cracks and three dimensionally one does both jobs of shear and spitting failures greatly at early ages. For the long term usage, they have neglected any effect on duration of peak loads. Mainly distributed steel fibres can improve shear failure significantly also at at initial stages it improves the energy accepting for the ductility of concrete under high compression, in spite of long terms steel fibres improvise ductility of harden concrete at compressive strengths on peak loads.

Afshari et al. [6] described about usage and length percentage of steel fibres for the energy consumed by slabs under flexure. The articles focuses on the distribution of steel fibres as well as volumetric changes noted in slab. In present study effect on concrete is studied on energy absorption and on different length of fibres. Results shows about the flexural test and within that load deflection as well as the energy absorbed illustrated in deflection curves. On addition of 0.5% of fibres there was energy absorption of 12 times that of plain concrete. Slabs with 1% of fibre takes energy absorption 2 times that of slab with 0.5 and 1.5% fibres, which all in all makes the energy absorption 1.5 times that in 1% of fibres. This given comparision on load deflection and theory prediction shows volumetric changes according to fibres added to specimens, with low fibre volume of 0.5% and resisting loads after cracking in specimens was relatively small. There was an improve in rate of energy absorption reduction in increment of fibres.

Haktanir et al. [7] described about three types of crack measurements on plain, reinforced and steel fibre concrete pipes of diameter 500 mm. Loads were applied on accounts of 25kg/m³ which turns more to be 82% greater and for smaller pipes of plain concrete it is 47%. Dosage of 6% in 40kg/m³ is given on steel fibres of 25kg/m³ which gaved an optimum result due to 60% increment in total part of steel fibres, by this investigation steel fibres are on to find the mechanical and physically properties increment are economical due to usage of steel fibres. In all it shows the longer type of steel fibres are more effective on steel fibre concrete pipes in spite of using fibres of short lengths. Not more than 500 mm diameter of steel fibre pipes should be casted. A steel fibre of 6% on dosage of 25kg/m³ had greater impact than using 15% for having reinforcement of 5.1cm².

Soulioti et al. [8] showed the mechanical behaviour of concrete and reinforced with steel fibres of different geometry and volume fractions. Test includes compression test and four point bending tests. Articles leads to the conclusion that fibres plays a significant role in hardened concrete specimens. There are numerous changes noted like slump, air content and about volume fractions. Current study puts light on effect of geometry of fibre on steel reinforced concrete specimens. On addition of steel fibres the slump decreases on comparison to plain concrete and air content increases on addition to greater volume fraction on fibres. This is due to fact that consolidation of fibre-reinforced concrete becomes more difficult with increasing the fibre volume fraction, leading to an increase of air content in the material.

Burcu et al. [9] showed design and workability plus the mechanical properties of hybrid steel fibre reinforced self-compacting concretes. Different types of steel fibres with hooked and non-hooked ends were added into two fractions. Furthermore they showed results of slump flow, V funnel and J ring tests for increasing contents of fibres and workability of concrete. Based on test, concluded it concluded that fibres has a slightly decreasing effects on workability of steel fibre reinforced concrete which also puts light on flowability for geometry of long fibres rather than strength. Dispersion and alignment of fibres have effects on mechanical properties of concrete which analyses high volume of fibres used for compacting concrete.

Fracture energy test gives result about concrete with higher strengths due to involvement of long type of steel fibres which gives more toughness and ductility in compare to control mixes. Concrete with normal steel fibres gives fracture due to slipping of fibres into concrete specimens. Results showed images which were analyzed on usage of high usage of fibres in self compacting concrete without clump, long fibres shows oriented improvement in toughness of concrete.

Mo et al. [10] did series of experiment was carried out to examine on amount of steel fibres used on mechanical and durability properties of concrete and to evaluate the flexural and ductility and modulus of elasticity too. Two types of hooked fibres were used as reinforcement in beam specimens of size 150 mm × 150 mm × 500 mm. A sequence of experiments was carried out to explore the effect of size, shape and amount of steel fibres on the mechanical properties of concrete, such as the compression, first-crack flexural strength and ultimate flexural, modulus of elasticity, flexural toughness and ductility. The addition of steel fibres shows improved flexural strength, toughness and ductility. Test derived results about flexural performance of fibre using parameters derived from load deflection curve obtained under third point loading. Prime focus is to determine and compare the behaviour and addition of steel fibres to regulate the strength of concrete beams. Flexural tests (ASTM 1609 (American Society for Testing Materials), ASTM 2007 (American Society for Testing Materials)) on small-sized steel fibre concrete beam specimens made by different concrete strengths, fibre type and fibre dosage were carried out. The test method evaluated the flexural performance of fibre concrete using parameters derived from the load-deflection curve obtained by testing a simply supported beam under third-point loading. An increase of 30–120% was observed in the ultimate flexural capacities of beam specimens when steel fibre content was increased from 0.5% to 1.5% by volume of concrete. In the beam specimens with 0.5% dosage of Type-1 fibres, an increase in the fibre length (i.e. from short to long fibres) attributed to a significant increase (of about 30%) in the flexural toughness values. The beneficial effect of fibre length on flexural toughness became less significant at higher dosage of steel fibres in the beam specimens.

Sharma et al. [11] compared the properties of high strength concrete using foundry slag and alccofine 1103 for different curing ages for 7, 14, 28, 56 and 90 days. Foundry slag is done as a partial replacement for fine aggregates and alccofine as a partial substitute for ordinary Portland cement. Concrete specimens of M100 grade using water bind ratio of 0.239 for varying percentages in compressive strengths, tensile strength and flexural strength for curing days up to 90 days. Results showed about mixes of all curing ages, ratio of split tensile strength to compressive strength from 7 to 8%, whereas the flexural to compressive strength was found to vary from 10 to 12.49%.

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