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A Literature Review On Study Of Colloidal Nano-Silica And Polypropylene Fiber As Partial Replacement Of Cement In Conventional Concrete

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Abstract : In the recent year, there has been considerable attempts for improving the properties of concrete with respect to strength and durability, especially in adverse environments. High performance concrete appears to be better choice for a strong anddurable structure. A large amount of by-product or wastes such as fly-ash, copper slag, silica fume etc. are generated by industries, which causes environmental as well as health problems due to dumping and disposal. Proper introduction of Colloidal Nano silica and Polypropylene fiber in concrete improves both the mechanical and durability characteristics of the concrete. This paper present literature review on replacement of Cement by Colloidal Nano silica and Polypropylene fiber which includes current and future trends of research.

Keywords – Colloidal Nano-Silica Liquid (NS),) Compressive strength (CS), Cement, Polypropylene Fiber (PPF)

1. INTRODUCTION

Construction is the backbone of infrastructural development and it derives its basic ingredients, which are cement, sand and stone aggregate from nature. In the current scenario, the construction works is on boom, which leads to various environmental hazards. The construction industry has ruined the ecological balance up to a great extent by taking away the natural stock of argillaceous and calcareous rock. To reduce the dependence on natural material as the main source of concrete, artificially manufactured and industrial waste provide an alternative for construction industries. Nano-Silica Liquid and Polypropylene Fiber are considered as a waste material which could have a promising future in construction industries as partial or full substitute of fine aggregate. The use of Nano-Silica Liquid and Polypropylene Fiber in concrete provides potential environment as well as economic benefits for all construction industries, particularly in those areas where a considerable amount of Nano-Silica Liquid and Polypropylene Fiber is produced. The chances of pollution due to Nano- Silica Liquid and Polypropylene Fiber will be reduced and it will be cost effective for construction. The use of waste material in new construction helps to save of energy. The use of Nano-Silica Liquid and Polypropylene Fiber in concrete mix can also solve the problem of disposing these waste materials.

2. LITERATURE REVIEW

M. H. S. Hisham Shah, C. C. Lee,M. Zamzuri and V. Vijayan (2022) studied that the effects of CNS incorporation on the properties of coir-cement bricks at various dosages and curing ages were investigated in this study, and the following result was reached As the dosage of CNS incorporation was raised, the flexural strength rose. After 28 days of curing, incorporating 4% CNS resulted in a greater strength of 6.39 MPa. Beyond this, flexural strength decreases noticeably owing to the presence of too much nanosilica, which repressed the hydration process.

Dr.A.Thirumurugan (2020) studied that the compressive strength of cubes increases upto 3% replacing of cement with nanosilica.

Chenglong Zhuang and Yu Chen (2019) Studied When nano-SiO_2 is used to replace part of the cement, the high activity of nano-SiO_2 helps to promote the hydration reaction of concrete, which shortens the setting time of nano-SiO_2.

N.Mohanraj, E.Arundhava Priya, A.Gopalan (2019) This paper studies that the mechanical properties of the hybrid concrete were carried out. The present study aims at producing the concrete specimen by reinforcing constant level of fibers (steel fibers of 0.7%, and polypropylene fibers of 0.3%) with the different percentage (5%, 10%, 15% and 20%) ofsilica fume and then comparing it with normal and fiber reinforced concrete. Different tests were carried out on thehybrid concrete specimen like compressive strength test, flexural strength test, and durability tests on normal concrete, the hybrid concrete exhibits series of crevice while loading and also has higher flexural and compressive strength than the normal concrete.

Swapnil Gupta (2018) studied the Effect of colloiodal nano silica and polypropylene fiber on the strength and durability characteristics of M40 concrete.The main parameter investigated in this study isM40 grade concrete with partial replacement

of cement by colloiodal nano silica by 0%, 5%, 10% and polypropylene fiber by 0%,0.5% and 1.0% a detailed experimental study in Compressive strength, flexural strength at age of 7,14 and 28 day was carried out. Results Shows that colloiodal nano silica and polypropylene fiber in concrete has improved the performance of concrete in strength as well as in durability aspect.

Akash Kumar, Gurpreet Singh (2018) has investigated that From the compressive strength results, it can be observed that increase in compressive strength of cement mortar is observed on addition of a certain minimum quantity of Nano- Silica. The increase in strength is maximum for Nano silica 5% by weight of cement**.**

Irfaz ur Rahman Najar, Jagdish Chand kambooj (2018) has investigated that fiber addition On the basis of existing review of literature it can be concluded that the strength increases in concrete with increases in silica fume rate upto 15%after that it gets decreased, but by adding steel fibre upto 2% the strength gets increased upto 10%-15%.On other side when fly ash is added to the plain concrete. It has been noted that the higher the percentage of F.A the higher the valuesof compressive strength until 30% of F.A, after that the increase in the percentage of F.A lead to decrease in values of concrete compressive strength. Overall the best results are shown at the percentage of 15%-20% of adding silca fume andfly-ash.

Rahul Dogra, Ankit (2016) has investigated on concrete mix design of M25 grade by adding various types of admixtures and get more strength as well as its become economical mix design as far as cast is concern. They observed that more strength than require strength in M25 grade so they reduced the grade like M15 and get the target strength. They took target strength 30. Thus for target strength 30 they can use this type of mix design by adding various types of admixtures in grade of M15 and mix design became economical. Compressive strength of steel and glass fiber at 28 daysis 49.84 N/mm2 and 25.72 N/mm2 respectively. The scope of present research accord with the strength properties of concrete, on the effect of fractionally substitution of cement by silica fume with different percentages viz 0%, 5%, 7.5 and 10% was used in the concrete and polypropylene fiber used with percentage 0%, 0.5%. Strength Properties studies involve compressive strength flexural strength tensile strength and abrasion. In present research the strength properties ofhigh strength concrete of M30 grade at 7 days 14 days 28 days characteristic strength with different replacing levels of cement with silica fume are consideration. Standard cubes 15cm x 15cm x 15cm, standard cylinders 15cm dia x 30cm height and standard beam 10cm x 10cm x50cm were considered in the research. The study bring that the use of waste material like silica fume develop the strength properties of concrete, which is otherwise unsafe to the environment and thus may be used as a fractionally replacement of cement. The partial replacement of 10% silica flume with cement can giving most extreme conceivable compressive strength with polypropylene fiber. Addition of polypropylene fiber improves the tension stiffening effect considerably and this increase the bond stress of reinforced bars in composite fiber reinforced concrete than in plane concrete. Silica fume has no large impact on flexural strength of concrete. In this perspective tests results exhibited in this study, it is fulfilled that a mixed design through 10% silica flume and 0.05% fiber volume division was ideal in flexural quality by means of keeping up an attractive workability. Workability and flow characteristics are reduce by adding of polypropylene fibers in concrete mix; and it also diminishes segregation and bleeding in the concrete blends. The early age shrinkage of polypropylene fibers decrease and dampness loss of the concrete blend not withstanding when low volume divisions of polypropylene fiber are used. The deformation limit of concrete improve by addition of polypropylene fibers (PPF) and also upgrades the material ductility of concrete. Polypropylene fibers reduce the settlement, plastic, water permeability and shrinkage.

D.Prasanya, S.Vignesh, R.Gurulakshmi, B.Boomapriya (2016) studied that silica fume(SF) is used as a partial replacement of cement and polypropylene fiber (PP)is added in order to investigate the mechanical properties of concrete. Silica fume were partially replaced from 5% to 25% and 0.1% of polypropylene fiber were added to test for its compressive and tensile strength. The result of 7th and 28th days of concrete were compared with those of conventional concrete, reveals that silica fume in combination with polypropylene fiber yields high strength both in compression and in tension. The addition of polypropylene fiber increases the strength of concrete by reducing its unit weight whereas the silica fume act as a better replacing material with its own characteristics. It is observed that the optimum percentage for replacement of Silica fume is 10% and addition of 0.1% Polypropylene fiber increases the compressive and tensile strength up to 27.18N/mm2 and 4.4N/mm2 respectively.

3. CONCLUSION

The review of earlier studies related to partial replacement of Cement with Colloidal Nano Silica and Polypropylene Fiber reveals that there is a significant change in the strength properties of concrete such as compressive strength, flexural strength,. These experiments were carried out in various grade concrete to find out the result. From the above literature reviews optimum percentage of colloidal Nano Silica varies from 5% to 15% and Polypropylene Fiber varies from 0% to 1%. Up to these Percentage Replacement improvement in the strength of concrete has been observed in terms of Compressive Strength, Flexural Strength and Tensile Strength on partial replacement of Cement with colloidal Nano Silica and Polypropylene Fiber Previous studied also shows that colloidal Nano Silica, Silica Fume and Polypropylene fiber concretes possess superior durability properties.

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