iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VIII **Month of publication:** August 2022

DOI: https://doi.org/10.22214/ijraset.2022.46444

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VIII Aug 2022- Available at www.ijraset.com

Investigation on Polypropylene Fiber Reinforced Concrete with Alccofine-1203

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Abstract: ***In this study, cement containing Alccofine-1203, which is finer than cement and gives the concrete structure greater strength and endurance. Polypropylene fibers are used to enhance strength properties of concrete. Fibers made of polypropylene are added at rates of 0, 1.5, and 2.0%. Cement that has been mixed with several amounts of Alccofine-1203, including 5, 10, 7.5, and 12.5%. For concrete that has set, strength tests are performed after 28, 56 and 90 days. To evaluate the mechanical characteristics of concrete, destructive tests are performed on the dried specimens.***
Keywords: Alccofine 1203, Polypropylene fibres, Compressive strength and Split tensile strength.

I. INTRODUCTION

Concrete is a composite material made of coarse aggregate joined by fluid cement that gradually becomes harder. The most common types of concrete are those manufactured using other hydraulic cements or lime-based concretes like Portland cement concrete. However, asphalt concrete, which uses bitumen as the cement, is also a type of concrete that is used for road surfaces. Polymer concretes, which employ polymers as the cement, are also occasionally used. When the aggregate, dry cement, and water are combined to make Portland cement concrete (and other hydraulic cement concretes), they create a fluid mass that is simple to shape.

The primary production materials today are cement-based, and this significance will most likely remain in the future. They must compete with other construction materials in addition to plastic, metal, and wood while dealing with challenges related to production, the economy, quality, and the environment. Durable concrete will maintain its quality and usability even when exposed to the elements. Fine mineral powders such as fly ash, ground-granulated blast furnace slag, limestone, silica fume, and aluminium fine should be used to make cement-based ingredients for concrete. When producing concrete, these cement-based components are combined with cement in the mixer.The primary production materials today are cement-based, and this significance will most likely remain in the future. They must compete with other construction materials in addition to plastic, metal, and wood while dealing with challenges related to production, the economy, quality, and the environment. Durable concrete will maintain its quality and usability even when exposed to the elements. Fine mineral powders such as fly ash, ground-granulated blast furnace slag, limestone, silica fume, and aluminium fine should be used to make cement-based ingredients for concrete. When producing concrete, these cement-based components are combined with cement in the mixer.The primary production materials today are cement-based, and this significance will most likely remain in the future. They must compete with other construction materials in addition to plastic, metal, and wood while dealing with challenges related to production, the economy, quality, and the environment. Durable concrete will maintain its quality and usability even when exposed to the elements. Fine mineral powders such as fly ash, ground-granulated blast furnace slag, limestone, silica fume, and aluminium fine should be used to make cement-based ingredients for concrete. When producing concrete, these cement-based components are combined with cement in the mixer.The primary production materials today are cement-based, and this significance will most likely remain in the future. They must compete with other construction materials in addition to plastic, metal, and wood while dealing with challenges related to production, the economy, quality, and the environment. Durable concrete will maintain its quality and usability even when exposed to the elements. Fine mineral powders such as fly ash, ground-granulated blast furnace slag, limestone, silica fume, and aluminium fine should be used to make cement-based ingredients for concrete. When producing concrete, these cement-based components are combined with cement in the mixer.The primary production materials today are cement-based, and this significance will most likely remain in the future. They must compete with other construction materials in addition to plastic, metal, and wood while dealing with challenges related to production, the economy, quality, and the environment. Durable concrete will maintain its quality and usability even when exposed to the elements.

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This paper provides details regarding the behaviour of alccofine in concrete. Alccofine is a micro-fine material produced in India that contains particles that are even finer than those found in cement, fly ash, silica, and many other cement-based products. Because of its optimum particle size distribution, this material has a unique ability to improve concrete's performance at all stages. Chemical reactions between the cement, water, and other chemicals create a rigid matrix that binds all the components into a long-lasting substance that resembles stone and has a variety of functions. Alccofine is a brand-new generation of micro-fine material produced in India that has significantly smaller particles than other hydraulic materials like cement, fly ash, silica, etc.

II. OBJECTIVES

To maximize the percentage of partial Alcofine-1203 substitution in cement.

III. MATERIALS

Table 1: The properties of cement, fine and coarse aggregate represented.

S.No.	Property	Cement (53grade)
1	Specific gravity	3.17
2	Fineness	9.19
3	Consistency	33%
4	Initial setting time	33 min
5	Final setting time	510min

A. Alccofine-1203

Compared to cement, fly ash, and other materials of a similar kind, Alccofine 1203 is a new generation micro- fine material. This experiment used the mineral ingredient Alccofine from Ambuja Cements Ltd. Alcofine 1203 is an additional cementitious component that can take the place of silica fume in high-performance concrete. It is constructed using supplies utilised in the iron ore industry. Alccofine has a higher percentage of alumina and silica content in its chemical composition. Concrete can function more effectively in both the fresh and hardened stages thanks to certain characteristics of it. It can be used as a good substitute for silica fume. The strength and longevity of concrete of all ages are improved by the use of Alccofine 1203 as a cement substitute.

B. Polypropylene Fibers

A synthetic fibre made from 85% propylene and utilised in a number of applications, polypropylene fibre is also known as polypropylene or PP. Although there are many various sectors that use it, the production of carpet yarns is one of the most common. For instance, this fibre is used to make the majority of affordable carpets for light residential use. The fibre is lightweight, thermoplastic, robust, and resistant to mildew and several chemicals.

C. Concrete Mix Design

The mix design conducted in the laboratory conditions by trial and error and confirming to IS: 10262-2009 for M40 grade of concrete. The weight ratio of mix proportion is 1:1.28:2.41 with water cement ratio 0.4.

IV. EXPERIMENTAL INVESTIGATIONS

A. *Compressive Strength Results*

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in Table 2to 4.

Table 2: Compressive strength of concrete with alccofine-1203

S.No.	% of alccofine-1203	Compressive strength results,N/mm^2		
		28days	56days	90days
1	0%	52.30	56.73	61.13
2	5%	56.58	61.61	66.07
3	7.5%	60.32	65.62	70.45
4	12.5%	55.54	60.52	64.83

Table 3: Compressive strength of concrete with polypropylene fibers

S.No.	% of polypropylene fibers	Compressive strength results, N/mm^2		
		28days	56days	90days
1	0%	52.30	56.73	61.13
2	0.5%	57.59	62.71	67.29
3	1.5%	62.68	68.12	73.19
4	2%	56.95	62.05	66.51

Table 4: Combined compressive strength of concrete with alccofine-1203 and polypropylene fibers

S.No.	% of polypropylene fibers	Compressive strength results, N/mm^2		
		28days	56days	90days
1	0%	52.30	56.73	61.13
2	7.5%AL+1.5%PF	66.68	72.66	77.80

Table 5: Split tensile strength of concrete with alccofine-1203

S.No.	% of alccofine-1203	Split tensile strength results,N/mm^2		
		28days	56days	90days
1	0%	5.07	5.52	5.96
2	5%	5.47	5.92	6.38
3	7.5%	5.76	6.26	6.72
4	12.5%	5.42	5.88	6.32

Table 6: Split tensile strength of concrete with polypropylene fibers

S.No.	% of polypropylene fibers	Split tensile strength results, N/mm^2		
		28days	56days	90days
1	0%	5.07	5.52	5.96
2	0.5%	5.57	6.06	6.48
3	1.5%	5.98	6.51	6.98
4	2%	5.56	6.04	6.53

Table 7: Combined Split tensile strength of concrete with alccofine-1203 and polypropylene fibers

S.No.	% of polypropylene fibers	Split tensile strength results, N/mm^2		
		28days	56days	90days
1	0%	5.07	5.52	5.96
2	7.5%AL+1.5%PF	6.65	7.24	7.76

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V. CONCLUSIONS

A. The compressive strength of normal concrete at 28,56 and 90 days is 52.30, 56.73 and 61.13 N/mm^2.

B. The split tensile strength of normal concrete at 28,56 and 90 days is 5.07 , 5.52 and 5.96 N/mm^2.

C. At 7.5% of Alccofine 1203 with partial replacement of cement the compressive strength result is 60.32 , 65.62 and 70.45 N/mm^2 for 28,56 and 90 days.

D. At 7.5% of Alccofine 1203 with partial replacement of cement the split tensile strength result is 5.76 , 6.26 and 6.72 N/mm^2 for 28,56 and 90 days.

E. At 1.5% of Polypropylene fibres in concrete the compressive strength result is 62.68 , 68.12 and 73.19 N/mm^2 for 28,56 and 90 days.

F. At 1.5% of Polypropylene fibres in concrete the split tensile strength result is 5.98 , 6.51 and 6.98 N/mm^2 for 28,56 and 90 days.

G. By Combination of 7.5% of Alccofine 1203 and 1.5% of Polypropylene fibres the compressive strength results is 66.68, 72.68 and 77.80 N/mm^2 for 28, 56 and 90 days.

H. By Combination of 7.5% of Alccofine 1203 and 1.5% of Polypropylene fibres the split tensile strength results is 66.68, 72.68 and 77.80 N/mm^2 for 28, 56 and 90 days.

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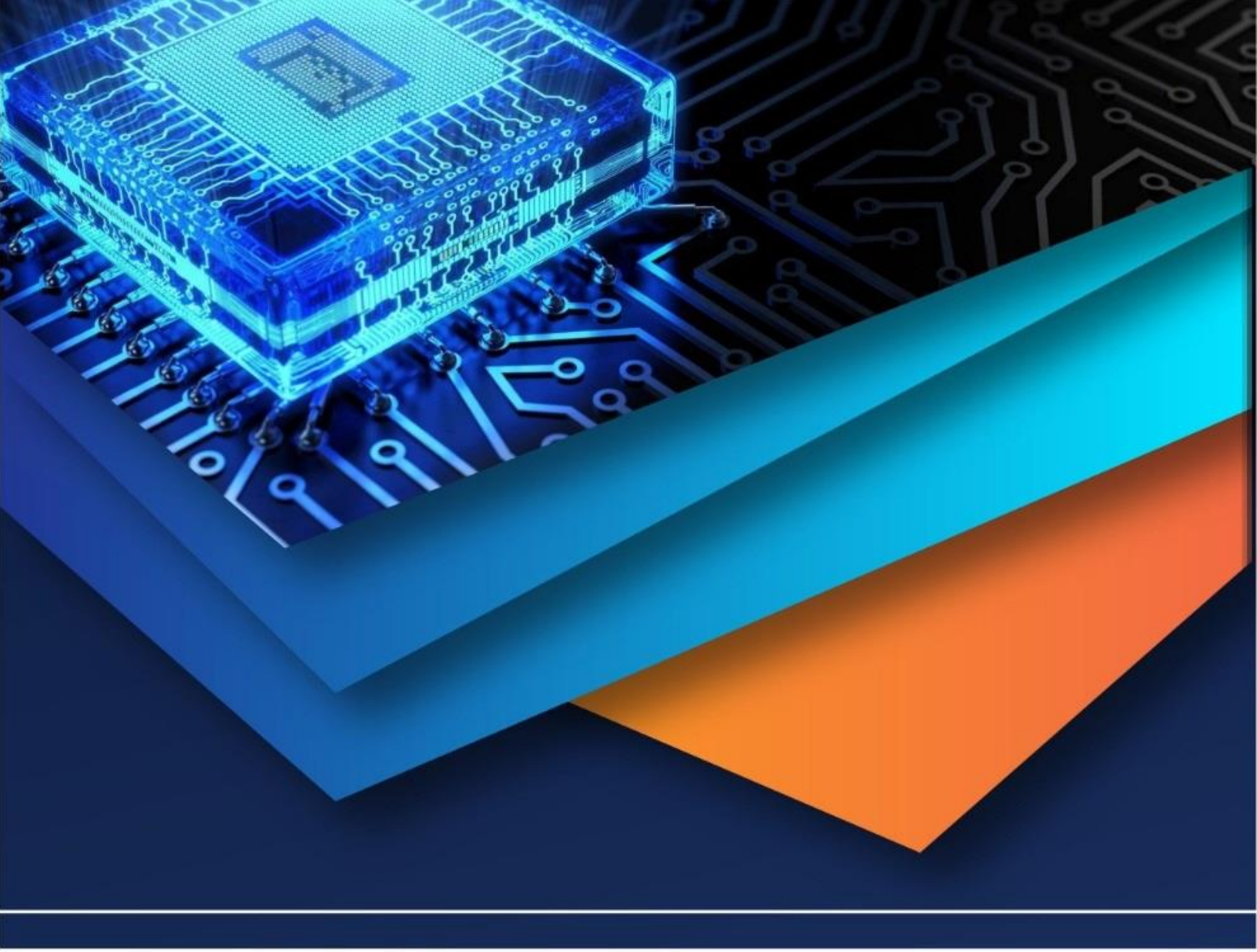

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