North Asian International Research Journal of Sciences, Engineering & I.T.

IRJIF. I.F. : 3.821

ISSN: 2454-7514 Vol. 9, Issue-12 December-2023

Index Copernicus Value: 52.88 Indian Citation Index Thomson Reuters ID: S-8304-2016

NAIRJC

A Peer Reviewed Refereed Journal

DOI: 10.5949/nairjseit.2023.10.12.1

EXPERIMENTAL ON POLYPROPYLENE FIBRE CONCRETE BY USING PARTIAL REPLACEMENT OF NATURAL ADMIXTURE WITH FINE AGGREGATE ANDTITANIUM DIOXIDE WITH CEMENT

[1] DR.K.CHANDRAMOULI, 2 J.SREE NAGA CHAITANYA, [3]K.DIVYA, [4] SHAIK MOTHAD SUBHANI

[1] Professor & HOD,[2&3]Assistant Professor,[4]P.G. Scholar

[1,2,3,4] Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh, India.

ABSTRACT

The strength performance of concrete reinforced with polypropylene (PP) fibre is examined in this work. Polypropylene (PP) fiber is added to M30 grade concrete in 0%, 0.5%, 1%, 1.5%, and 2%. Our ancestors employed a range of plants as natural admixtures during construction to improve the structure's overall performance. It is more appropriate to combine the traditional idea with contemporary architecture. Consequently, in lieu of chemical admixtures, the workability, compressive strengths, and porosity of herbal extracts are being evaluated. Titanium dioxide is a white mineral that occurs naturally that cleans by absorbing hazardous impurities and adding it to cement. To give porcelain enamels their brightness, hardness, and acid resistance, titanium dioxide has been used as an pacifying and bleaching agent. Natural admixture (chebula powder) is partially replaced with fine aggregate 0.25%,0.5%,0.75%,1%. Titanium dioxide is partially replaced with cement 0.25%,0.5%0.75%,1%,1.2%. Compressive and tensile strength tests are performed on concrete at 7 and 28 days to ascertain its mechanical properties.

***KEYWORDS**: Polypropylene Fiber, Natural Admixture, Titanium dioxide .Compressive Strength and Split Tensile Strength*

1. INTRODUCTION

Concrete is the most significant foundation material in all civil engineering buildings and the most dependable and long-lasting building material in the world. Cement, water, fine aggregate, and coarse aggregate are the components of concrete. Most concretes that are used have a lime basis, such as Portland cement concrete or concretes that are made using several hydraulic cements. The most important building material is cement, and it's very likely that this material will continue to be important in the future. The materials used in building and engineering have to meet ever-increasing specifications.

During construction, our ancestors added a range of plants as admixtures to improve the overall performance of the structure. The white mineral titanium dioxide, which is found naturally, cleans the cement by absorbing harmful pollutants. Titanium dioxide is used as an opacifying and bleaching agent in porcelain enamels to give them brightness, hardness, and acid resistance. A non-polar, somewhat crystalline member of the polyolefin family is polypropylene. Its properties are comparable to polyethylene, although it is slightly stronger and more heat resistant. It is a white, mechanically tough compound that has a good chemical resistance. Bio-PP is the biobased version of polypropylene (PP). The second most widely produced commodity plastic after polyethylene is polypropylene.

2. OBJECTIVES

The following are the study's objectives:

a. To maximise the use of Titanium dioxide in cement.
b. To maximise the use of natural aggregate as the fine aggregate.
c. To assess results from split tensile and compressive strength testing.

3. MATERIALS

a. Cement: The primary use of cement is as a binder in concrete, which is used in building and hardens to bond other materials. In building, ordinary Portland cement (OPC) of grade 53 is utilised.

b. Fine aggregate: Made mostly of crushed stone or natural sand, fine aggregate is a crucial component of concrete. The concrete's hardened qualities are significantly influenced by the density of tiny particles.

c. Coarse aggregate: Coarse aggregate is defined as the aggregate that is kept above IS Sieve 4.75 mm. According to IS 383:1970, the usual maximum size is progressively 10–20 mm.

d. Water: One of the most crucial components of building is water, which is needed for curing work, mixing cement concrete, and preparing mortar, among other things. The strength of the motor and cement concrete during

building is directly impacted by the quality of the water utilized.

e. Natural Admixture: Extract from Kadukkai (Terminalia chebula) is used as a Natural Admixture (NAD).It was collected from local stores, powdered, and combined with concrete. Its binding and hardening properties are exceptional. Keeping the previously described logic in mind, the goal of this study is to show that natural organic plant extract can be used in place of or in addition to chemical admixtures.

f. Titanium dioxide: A remarkable photocatalytic substance that gives cement-based products biocidal, self-cleaning, and smog-abating qualities. TiO2 has an impact on how cement hydrates and how its internal structure develops. This article discusses the formation of a cement pore network and the hydration process. Titanium and oxygen combine to form titanium dioxide, a naturally occurring substance. It is a nonliving substance.

g. Polypropylene Fiber: Anon-polar, somewhat crystalline member of the polyolefifin family is polypropylene. Its properties are comparable to polyethylene, although it is slightly stronger and more heat resistant. It is a white, mechanically tough compound that has a good chemical resistance. Bio-PP is the biobased version of polypropylene (PP). The second most widely produced commodity plastic after polyethylene is polypropylene.

4. RESULTS AND DISCUSSIONS:

a. Compressive strength test: The cube specimens of 150mm x 150mm x150mm were cast and tested in compression testing machine for 7 and 28days of curing period for different proportions of concrete mix and presented in table 2.

Table 1: Compressive strength result on concrete by chebulla powder as partial replacement of fine aggregate.

S.No.	% of Chebulla powder	Compressive Strength, N/mm^2	
		7 Days	28 Days
1	0%	25.34	38.76
2	0.25%	31.62	48.49
3	0.5%	32.71	49.64
4	0.75%	33.58	50.69
5	1%	31.69	47.73

Table 2: Compressive strength result on concrete by Titanium dioxide as partial replacement of cement

S.No	TIO_2	Compressive strength results, N/mm^2	
		7 days	28 days
1	0%	25.34	38.76
2	0.25%	26.71	41.59
3	0.5%	28.49	43.77
4	0.75%	29.73	45.05
5	1%	30.31	45.78
6	1.2%	29.73	44.42

Table 3: Compressive strength result by addition of Polypropylene fibre in concrete

S.No	PPF	Compressive strength results, N/mm^2	
		7 days	28 days
1	0%	25.34	38.76
2	0.5%	27.41	42.68
3	1%	28.93	44.38
4	1.5 %	30.65	46.45
5	2%	30.12	45.44

Table 4: Compressive strength of concrete for combined partial replacement of fine aggregate by 0.75% chebulla powder + cement by 1 % Titaniumdioxide + and addition of 1.5 % Polypropylene fibre.

S.No	$CP+TIO_2+PF$	Compressive strength results, N/mm^2	
		7 days	28 days
1	0%	25.34	38.76
2	$0.75\%CP+1\%TIO_2+1.5\%PPF$	43.34	61.93

Split tensile strength:

At the age of 7 and 28days, the cylindrical specimens (150mm diameter x 300mm height) were tested for evaluating the split tensile strength. The experiment is performed by putting a cylindrical sample horizontally between a compression testing machines.

Table 5: Split tensile strength result on concrete by chebulla powder as partial replacement of fine aggregate.

S.No.	% of Chebulla powder	Split tensile Strength, N/mm^2	
		7 Days	28 Days
1	0%	2.65	3.87
2	0.25%	3.26	4.82
3	0.5%	3.44	4.94
4	0.75%	3.49	5.01
5	1%	3.28	4.71

Table 6: Split tensile strength result on concrete by Titanium dioxide as partial replacement of cement

S.No	TIO_2	Split tensile strength results, N/mm^2	
		7 days	28 days
1	0%	2.65	3.87
2	0.25%	2.84	4.15
3	0.5%	2.99	4.34
4	0.75%	3.07	4.45
5	1%	3.15	4.52
6	1.2%	3.09	4.38

Table 7: Compressive strength result by addition of Polypropylene fibre in concrete

S.No	PPF	Split tensile strength results, N/mm^2	
		7 days	28 days
1	0%	2.65	3.87
2	0.5%	2.96	4.25
3	1%	3.08	4.42
4	1.5 %	3.16	4.59
5	2%	3.08	4.48

Table 8:Split tensile strength of concrete for combined partial replacement of fine aggregate by 0.75% chebulla powder + cement by 1% Titanium dioxide + and addition of 1.5 % Polypropylene fibre.

S.No	CP+TIO_2+PF	Split tensile strength results, N/mm^2	
		7 days	28 days
1	0%	2.65	3.87
2	0.75%CP+1%TIO_2+1.5%PPF	4.26	6.18

5. CONCLUSION:

1. At 0.75% replacement of Fine aggregate by chebullapowder the achieved compressive strength of concrete is 33.58N/mm^{2}and 50.69N/mm^{2}for 7days and 28 days.
2. At 1% replacement of cement by Titaniumdioxidethe achieved compressive strength of concrete is 30.31N/mm^2 and 48.78N/mm^{2}for 7days and 28 days.
3. By addition of polypropylene fibre in concrete the achieved compressive strength is 30.65N/mm^2 and 46.45N/mm^{2}for 7days and 28 days.
4. Combined partial replacement of fine aggregate by 0.75% chebulla powder + cement by 1% Titaniumdioxide + and addition of 1.5 % Polypropylene fibrein concrete the achieved compressive strength is 43.34N/mm^2 and 61.93N/mm^{2}for 7days and 28 days.

5. At 0.75% replacement of Fine aggregate by chebullapowder the achieved split tensile strength of concrete is 3.49N/mm^2 and 5.01N/mm^{2}for 7days and 28 days.
6. At 1% replacement of cement by Titaniumdioxide the achieved split tensile strength of concrete is 3.15N/mm^2 and 4.52N/mm^{2}for 7days and 28 days.
7. By addition of polypropylene fibre in concrete the achieved split tensile strength is 3.16N/mm^2 and 4.59N/mm^{2}for 7days and 28 days.
8. Combined partial replacement of fine aggregate by 0.75% chebulla powder + cement by 1% Titaniumdioxide + and addition of 1.5 % Polypropylene fibrein concrete the achieved split tensile strength is 4.26N/mm^2 and 6.18N/mm^{2}for 7days and 28 days.

6. REFERENCES:

[1].Dr.K.Chandramouli, Dr.N.Pannirselvam, J.Sree Naga Chaitanya, Dr.D.Vijaya Kumar.A Effect on Natural Admixture on Conventional Concrete and FlyAsh Blended Concrete.International Journal of Creative Research Thoughts,10(7),2022,f95-98.

[2].Paul shaji, K.P. Aswathi, P. Hanna, Jose K George and K. Shameer, "Effect of Natural Rubber Latex as admixtures in concrete", International Research Journal of Engineering and Technology (IRJET), vol. 4, pp. 2031-2034, 2017.

[3].G. K. Patel and S. V. Deo, "Effect of Natural Organic Materials as Admixture on Properties of Concrete", Indian Journal of Science and Technology, vol 9, pp. 1-8, 2016.

[4].A.H.Memon,S.S.Radin,M.F.M.Zain,and J.FTrottier, "Effect of mineral and chemical admixtures on high-strength concrete in sea water",Cement Concrete Research, 32, 2002,373–377.

[5]."Study on Engineering Properties of Concrete by using Terminalia ChebulaPowderasNatural Admixture" ISSN: 2348 – 8352, SSRG International Journal of Civil Engineering(SSRG - IJCE) – Special Issue ICITSET Sep 2018.

[6].M. Devasena, V. Sangeetha, "implications of Nano-titanium Dioxide incorporation in Cement Matrix",102(2),2021,567-573.

[7].JaySorathiya, Dr.Siddharth Shah, Mr. SmitKacha, "Effect on Addition of Nano "Titanium Dioxide" (TiO2) on Compressive Strength of Cementitious Concrete",1,201,219-225, ICRISET.

[8].J. Suresh Kumar, D. Gayathri, T. Naresh Kumar, "Study on behavior of TiO2 and GGBS with respect to mechanical and durability properties of sustainable concrete", 6(9), 2017, 18033-18044, IJIRSET.

[9].Hilalahmadwani, Sukhwinder Singh, Tahir Mohammad Bhat, "Effect of Nano Titanium dioxide and GGBS on Flexural Behavior of Concrete Beam", 2(12), 2020, 635-643, IRJMETS.

[10].M.VijayaSekhar Reddy, K.AshaLatha, M.Madhuri, K.Sasi, andC.VidyaSagar, "Effective Utilization of Herbocrete - A natural admixture in cement mortar to assess the strength properties", 3(1), 2018, 2456-1274, pp.31-36

[11].M.D.A.Thomas,M.H.Shehata,S.G.Shashiprakash,D.S.Hopkins,and K.Cailb,"Use of ternary cementitious systems containing silica fume and fly ash in concrete", Cement and Concrete Research 29,1999,1207–1214.

[12].M. Chaitanya Nava kumar, Dr. K.Chandramouli, J.Sree Naga Chaitanya,Dr.N.Pannirselvam. Strength Studies on Ar Glass Fiber Reinforced Concrete With Silica Fume, International Journal of Creative Research Thoughts,9(7),2021, g495-g498.

[13].Gopalakrishnan, Vishoni, R.K., M Tehri dam project (2003). Silica fume in HPC for ensuring Abrasion Erosion resistance.

[14].Eman K. Jallo, Experimental study on the behaviour of high strength concrete with silica fume under monotonic and repeated compressive loads, Al-Rafidain Engineering Vol.20 No. 2 March 2012.

[15].SRG International Journal of Civil Engineering (SSRG - IJCE) – Special Issue ICITSET Sep 2018. [11]. Aitcin, P. C. Hershey, P.A. and Pinsonneault (1981). Effect of the addition of condensed silica fume effect on the compressive strength of mortars and concrete.American Ceramic Society. 22:286-290.

[16].IJRTE,GajjalaPavan Kumar, A. Ravi Theja, "Effects of Mechanical Properties of Concrete with Tio2 and GGBS",9(1),2020,1924-1927.

[17].J. Sree naga chaitanya, dr. K. Chandramouli, g. Hymavathi, A. Medhasri mrunalini, a. Bhanu priya, strength studies on concrete by using kenaf fibers with partial replacement of cement with bamboo leaf ash, 04(06) (2022) e-issn: 2582-5208.

[18].G. Sandeep Reddy, Penki Ramu, M. Venkata Aneesh Mohan, A study on utilization of zeolite as partial replacement to cement for M40 grade concrete, International Journal of Engineering &Technology, 7 (4) (2018) 6322-6326.

[19].Dr. K.Chandramouli, J. Sree Naga Chaitanya, Dr.N.Pannirselvam, G.Jayasurya. Experimental Study on Papercrete Concrete, International Advanced Research Journal in Science, Engineering and Technology,8(7),(2017),367-371.

[20].Pannirselvam,N, Chandramouli,K, Anitha,V, (2018), Pulse Velocity Test on Banana Fibre Concrete with Nano Silica, International Journal of Civil Engineering and Technology, 9(11), pp. 2853-58.

[21].M. A. Mashrei, Ali A. Sultan, Alaa M. Mahdi. Effects of Polypropylene Fibers on Compressive And Flexural Strength of Concrete Material, International Journal of Civil Engineering and Technology,9(11),(2018), , pp. 2208–2217.

[22].S. Govindasami, P.B. Sakthivel and R. Harish. Strength Assessment of Polypropylene Fibre Reinforced Concrete (PPFRC), International Journal of Engineering & Technology, 7 (3.34) (2018) 436-438.

[23].Vairagade VS, Kene KS, Dhespande, NV (2012), Investigation on compressive and tensile behavior of fibrillated polypropylene fibre reinforced concrete, International Journal of Engineering Research and Applications, 2, 1111-1115.

[24].Alhozaimy AM, Soroushian P & Mirza F (1996), Mechanical properties of polypropylene fibre reinforced concrete and the effects of pozzolanic materials. Cement and Concrete Composites 18, 85-92.

[25].Dr.K.Chandramouli, J.Sree Naga Chaitanya, Dr.N.Pannirselvam,A. Murali Krishna. Ultra High Strength Concrete by Using Alccofine (1203),9(8),(2021),b41-b44.

[26].Chandramouli,K, Pannirselvam,N, Vijayakumar,D, (2019), Strength Studies on Pine Apple Fibre Concrete with Nano Silica, International Journal of Innovative Technology and Exploring Engineering, 8(7), pp. 3063-3065.

[27].J. Sree Naga Chaitanya , Dr. K. Chandramouli , M. Anil kumar , Dr.N.Pannirselvam. An Experimental Investigation on Properties of Concrete by Partial Replacement of Cement with Dolomite and Fine Aggregate with Crushed Sea Shell Powder,8(8),(2021),a955-a959.