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"Experimental Analysis of M35 Concrete with Partial Substitute of Fine Aggregate by Nylon Glass Filled Granules and Cement by Flyash"

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Abstract: ***Concrete is a material which widely used in construction industry. The present investigation deals with the study of partial replacement of fine aggregate by Nylon Glass Granules in concrete. The fine aggregates are replaced by 0%, 10%, 20% and 30% by Nylon Glass Granules by volume of natural sand in M35 grade of concrete. Additionally, to increase the tensile strength of concrete 1% of Steel Fiber by volume of cement were added to all the mixes containing Nylon Glass Granules. The concrete produced by such ingredients were cured for 7 and 28 days to evaluate its hardened properties. The 28days hardened properties of concrete revealed that maximum strength is observed for the mix which possesses 20% replacement of fine aggregate by Nylon Glass Granules compared with the conventional concrete, thus it is said to be the optimum mix.***

Keywords: ***Cement, Natural sand, Nylon Glass Granules(NGG), Steel Fiber, Fly ash, Compressive Strength, split tensile strength, Flexural Strength***

I. INTRODUCTION

Since the civilization started in this world, man has always been associated with a few forms of the construction activities, which also directly involves the use of cement concrete. In this present day world, the technical modifications have changed the development industry and construction activities.the final paper but after the final submission to the journal, rectification is not possible.

Building industry, made up of vertical and horizontal building. Vertical growth refers to the construction of the building and horizontal construction refers to the heavy construction. Construction of constructing structures such as government and private buildings involves the development of residential and non-residential buildingsCement Concrete is one of the most adaptable and widely used development products in the world. Concrete is the main building material that is commonly used throughout the world's building operations. Building operations are growing day by day, leading to excessive use of cement concrete.

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This project presents the feasibility of the usage of Nylon Glass Filled Granueles as partial substitute of fine aggregate in concrete and cement by fly ash further the compressive strength flexural strength & split tensile strength were studied

II. OBJECTIVES

- To obtain the Strength characteristics of FRC at different levels of replacement of FA with nylon glass filled granules in FRC.
- To check workability, consistency and slum value of FRC at fresh state
- To analysis overall strength (Compressive, split tensile & flexural Strength) of concrete at the hardened state.

III. LITERATURE SURVEY

- **SIMIAN AKCOZOGLU**

Having studied the use of PET plastic, it was concluded that the use of shredded PET granules as a result of its low unit weight reduces the unit weight of concrete resulting in the reduction of dead weight of the building would help to reduce the seismic hazard of building earthquake forces linearly based on dead weight.

- **YOUCEF GHERNOU**

Has done the study on partial replacement of fine aggregate in concrete by plastic by four mixtures where tested 10% , 20%, 30% and 40% The flexural and compressive strength were tested for 28 days reduction in the strength of both strength by increasing the percentage of plastic Recommendation of 10% to 20% replacement of fine aggregate with plastic waste

- **B.HARINI & K.V. RMANA**

They have conducted the experiment by partial replacement of fine aggregate by plastic with different mixes 5%, 6% , 8% , 10%, 15% , 20% by volume further it is observed that there is decrease in compressive strength in the ratio of plastic to aggregate was increased

- **Rafat Siddique, Jamal Khatib, Inderpreet Kaur**

It noted that this paper provides a detailed review of waste and recycled plastics, waste management methods, and published research on the impact of recycled plastic on concrete's fresh and hardened properties. This paper discusses permeability and resistance to abrasion. Not only does the use of waste products in concrete make it cost-effective, it also helps to reduce issues with disposal.Reuse of bulky waste is considered the best alternative to the environment to solve the disposal problem.

Another such waste is plastic that can be used in different applications.In concrete / asphalt concrete, however, efforts have also been made to explore its use. Developing new building materials using recycled plastics is critical for both the construction and recycling industries.

Zainab Z. Ismail, Enas A. AL-Hashmi

This studied the manufacturing practices in Iraq that are associated with significant amounts of non-biodegradable solid waste. Thirty kilograms of fibriform waste plastic were used as a partial 0 percent replacement for sand, 10 percent, 15 percent, and 20 percent with 800 kg of concrete mixtures. At room temperature, all concrete mixtures are tested. These tests include slump performance, fresh density, dry density, compressive strength, flexural strength, and indices of toughness. For compressive strength, 70 cubes were molded

IV. MATERIALS

CEMENT:

Cement is a material that binds. By adding water to a concrete mixture of cement, the cement begins to hydrate and binds the aggregates and connects materials like rocks and bricks. Generally, extra strength is provided by an abundant cement concrete blend (Cement concrete with more cement). After 30 minutes, the original setting time of cement begins and the final setting period of cement finishes after the 6 hours

SL. No	TEST	RESULT OBTAINED
1	Standard Consistency	40%
2	Fineness	3.00%
3	Initial setting time	32 min
4	Specific gravity	3.1

Fine aggregate

Natural river sand is used in cement concrete and cement mortar as the fine aggregates. They are a granular type of silica and the river bed deposits are its primary source. The main role of fine aggregates is to enhance and help concrete workability and keep consistency in the blend of cement concrete. Fine aggregates for use in concrete mixing must pass through the IS sieve of 4.75 mm and be held on the IS sieve of 75microns.

SL. NO	TEST	RESULT OBTAINED EXPERIMENTALLY
1.	Fineness Specific gravity	2.7
2.	Fineness	2.74

Coarse aggregate

These may be uncrushed or crushed stone gravel that is retained on the IS sieve of 4.75 mm. As for organic and vegetable matter, coarse aggregates to be used in building operations and concrete mixes should be powerful, durable, thick, transparent and safe. They should not be broken down into parts. It is important to avoid as far as possible flaky and elongated coarse aggregates.

S. NO	TEST	TEST RESULTS
1	Specific gravity	2.65
2	fineness	7.73

WATER

The water to be used in the concrete manufacture and healing of cement must be smooth and must not contain the damaging quantity of oils, acids, alkali, salt, sugar, organic materials, vegetables and extra substances damaging to cement concrete and steel. Water must also be free of chloride ions. The specifications of is:456-2000 should be met.

NYLON GLASS FILLED GRANULES

Nylon is a polymer; a plastic with super-long heavy molecules composed of short and less repeated bits of atoms, like a heavy metal string, nylon is not a single element, but the name given to a whole family of very similar materials. Glass-filled polymer or glass-filled plastic is a moldable composite material consisting of short glass fibers in a polymer material matrix. It is an ideal alternative to glass that offers flexibility in design, chemical durability and chemical and shatter resistance.

FLY ASH

The samples were obtained by Fly Ash from Raichur Thermal Power Station (RTPs) as per the requirements.

Fly ash or flue ash, also known in the United Kingdom as pulverized fuel ash, is a coal combustion material consisting of particulates (fine burned fuel particles) powered from coal-fired boilers along with flue gases.

Table: Physical Properties of Fly Ash

Sl. No.	Properties	Results
1	Specific Gravity	2.5
2	Fineness Modulus	4.5%

V. METHODOLOGY

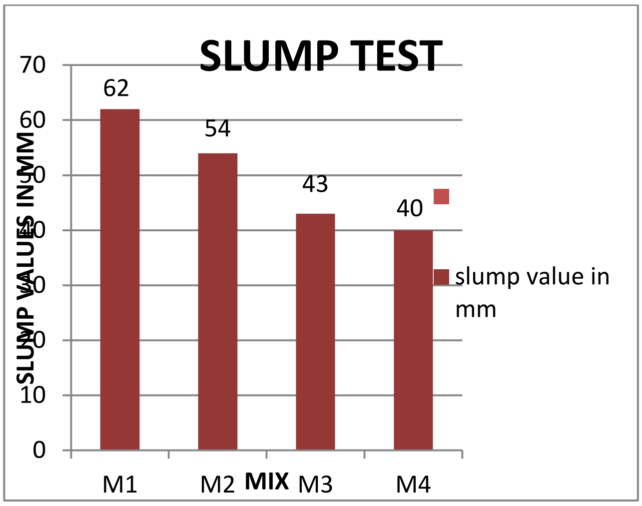
The following steps have been taken

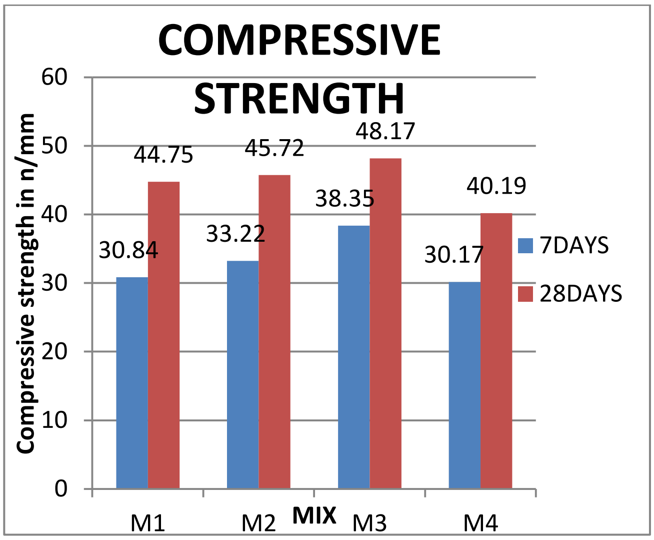
- Nylon glass filled granules, natural coarse and fine aggregate, cement
- Basic test on coarse aggregate, fine aggregate, nylon glass filled granules and cement.
- Concrete mix model is carried out according to IS 10262.
- FA is substituted in part by NYLON GLASS FILLED as 0%, 10%, 20% and 30%.
- Casting 36 numbers of cubes, 36 numbers of beams, 36 numbers of cylinders by ratios of 0 percent, 10 percent, 20 percent and 30 percent respectively with water cement ratios.
- Fly ash is replaced 10% by cement
- All cast samples are cured and tested for 7 days, and 28 days to assess the outcome.
- The following experiments are conducted as a cube compression test, cylinders split tensile test and beam flexural test.

VI. RESULTS

Slump test

SL NO	% OF NGG	% OF STEEL FIBRE	% OF FLY ASH	SLUMP (MM)
M1	0	0	0	62
M2	10	1%	10	54
M3	20	1%	10	43
M4	30	1%	10	40





COMPRESSIVE STRENGTH(CS) 7 DAYS

MIX	% NGG	% OF STEEL FIBRE	% OF FLY ASH	C S OF CUBE IN N/mm²	AVG. C S IN N/mm²
M1	0	0	0	31.25	30.84
				31.01	
				30.28	
M2	10	1%	10	33.18	33.22
				33.28	
				33.21	
M3	20	1%	10	38.25	38.35
				38.20	
				38.61	
M4	30	1%	10	30.05	30.17
				30.60	
				29.86	

COMPRESSIVE STRENGTH(CS) 28 DAYS

MIX	% NGG	% OF STEEL FIBRE	% OF FLY ASH	CS OF CUBE IN N /mm²	AVG. C S IN N/mm²
M1	0	0	0	44.60	44.75
				44.96	
				44.70	
M2	10	1%	10	45.70	45.72
				45.98	
				45.50	
M3	20	1%	10	48.28	48.17
				48.39	
				47.84	
M4	30	1%	10	39.98	40.19
				40.24	
				40.36	

Figure: Displays compressive cube testing

FLEXURAL STRENGTH (FS)

Table: Flexural Strength of prism for 7 days in N/mm²

MIX	% NGG	% OF STEEL FIBRE	% OF FLY ASH	FLEXURAL STRENGTH IN Nmm²	AVG. FLEXURAL STRENGTH IN N/mm²
M1	0	0	0	3.89	3.72
				3.61	
				3.67	
M2	10	1%	10	3.79	3.863
				3.90	
				3.76	
M3	20	1%	10	4.15	4.30
				4.42	
				4.35	
M4	30	1%	10	3.85	3.90
				3.95	
				3.90	

Table: Flexural Strength of prism for 28 days in N/mm^2

MIX	% NGG	% OF STEEL FIBRE	% OF FLY ASH	FLEXURAL STRENGTH IN N/mm^2	AVG. FLEXURAL STRENGTH IN N/mm^2
M1	0	0	0	4.46	
				4.64	
				4.53	4.54
M2	10	1%	10	4.44	
				4.54	
				4.66	4.56
M3	20	1%	10	5.06	
				5.71	
				5.1	5.62
M4	30	1%	10	5.4	
				5.65	
				5.34	5.48

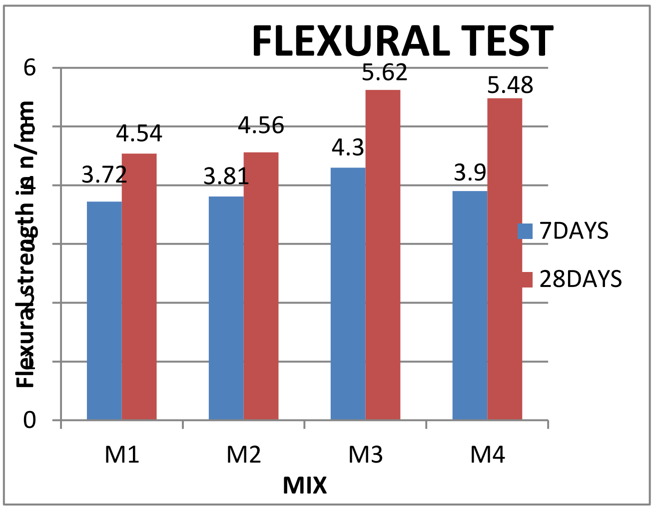


Figure: shows flexural testing of Prism

SPLIT TENSILE STRENGTH (STS)

Table: ST Strength of cylinder for 7 days in N/mm^2

MIX	% OF NGG	% OF STEEL FIBRE	% OF FLY ASH	ST STRENGTH OF CYLINDER IN N/mm^2	AVG. TENSILE STRENGTH IN N/mm^2
M1	0	0	0	3.07	3.082
				3.09	
				3.085	
M2	10	1%	10	3.06	3.057
				3.05	
				3.06	
M3	20	1%	10	4.07	4.033
				3.98	
				3.493	
M4	30	1%	10	3.48	3.483
				3.495	
				3.395	

Table: STS of cylinder for 28 days in N/mm^2

Mix	% Of Ngg	% Of Steel Fibre	% Of Fly Ash	St Strength Of Cylinder In N/Mm^2	Avg. St Strength N/Mm^2
M1	0	0	0	4.91	4.67
				4.80	
				4.31	
M2	10	1%	10	4.95	4.91
				4.90	
				4.88	
M3	20	1%	10	5.60	5.75
				5.80	
				5.85	
M4	30	[1%	10	4.12	4.65
				4.58	
				4.65	

Figure: demonstrates Split Tensile Cylinder

Sorptivity Test

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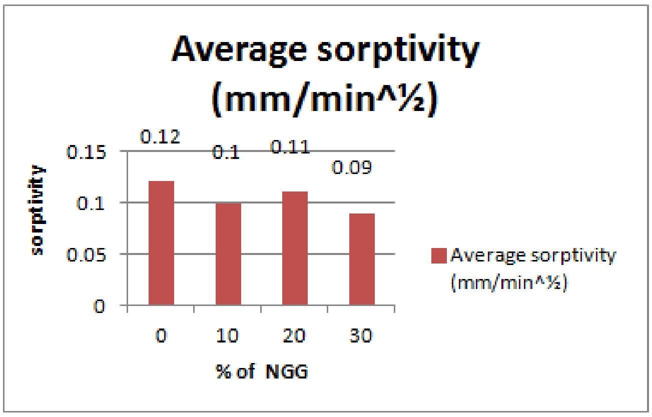
The 100 mm diameter x 50 mm height cylinder specimen was prepared from the core cutter and concrete cutting unit. After drying the oven at 1000C and cooling the specimen. Shortly after the sample is cooled, the water height above the specimen is held not more than 5 mm in a water bath for 30 minutes.

Table: Sorptivity Test of cylinder for 7 days in mm/min^½

MIX	% NGG	% OF STEEL FIBRE	% OF FLY ASH	DRY WEIGHT (grams)	WET WEIGHT (grams)	CHANGE IN WT. (w2-w1) gm	AVERAGE SORPTIVITY (mm/min^½)
M1	0	0	0	824.16	829.15	4.99	0.12
				824.10	828.6	4	
				824.14	829.14	5	
M2	10	1%	10	816.24	820.29	4.05	0.10
				815.56	820.06	4.5	
				816.09	820.09	4	
M3	20	1%	10	807.12	811.47	4.35	0.11
				807.01	811.03	4.02	
				807.25	812.25	5	
M4	30	1%	10	801.56	805.06	3.5	0.09
				800.96	804.81	3.85	
				801.60	804.70	3.1	



VII. CONCLUSION

- It is known that slump value increases by the percentage of nylon glass filled granules slowly decreases.
- As the amount of nylon glass filled granules increases, the compaction value increases slowly.
- As the percentage of nylon glass filled with granules reduces liquid absorption.
- It is notice that overall strength (CS, FS & STS) of concrete shows optimal results @ 20% of replacement of NS by nylon glass filled granules.
- Above 20%, the percentage of nylon glass filled granules increase the strength start decreasing gradually.
- The finding above indicates peak sorptivity after 7 days of healing at 20% of replacement.
- produce a 'greener' concrete for construction.
- Workability improves with the percentage of granules filled with nylon glass.
- By replacing natural sand with nylon glass filled granules, the mean target strength of M35 grade cement concrete is achieved with the above analysis.
- Using granules filled with nylon glass will make concrete economic.
- Sustainable and environmentally friendly concrete can be generated through this study by partially replacing the natural FA with nylon glass filled granules.

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