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Study on Structural Behavior of Nylon Fiber in Concrete

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Abstract: Nylon was discovered by Wallace Carothers in the year 1938 and its discovery led to the new age of fibers and textiles. Before the discovery of it, the thread that was used for clothing purpose was made of animal and plant fiber. But the fiber obtained from plants and animals was weak in strength and could easily be rotted. The strongest fiber known at that time was silk. Carothers reasoned that a fiber having the power similar to silk could be obtained when a polymer is a bond by an amide linkage. Nylon is very durable and has remarkable strength. As it is powerful, we can get fragile threads of plastic. The nylon fiber is used in making strong ropes and various fabrics.

Key words: Nylon, fibre, concrete, structural behaviour, plastic, textiles

INTRODUCTION

To study the strength of nylon fiber concrete and conventional concrete. Effect of fly ash and quarry dust as a partial replacement of cement and fine aggregate in concrete and experimental study on use of quarry dust and fly ash with partial replacement of fine aggregates and cement in concrete are introduced by Rohini and Arulars (2016) and Saiyad *et al*. (2016). To carry out the comparative study of nylon fiber concrete and traditional concrete strength. The primary objective of this research is to increase the power of concrete by using nylon thread. Experimental study on partial replacement of cement with fly ash and omplete and replacement of sand with M sand are discussed by Subramani and Ramesh (2015). Nylon fiber is a heat resistant material. Thus, it prevents the formation of cracks. A partial replacement for coarse aggregate by seashell and cement by flyash in concrete is presented by Yuvaraj (2010). With the increase in construction activities there is the massive demand for concrete and consequently on its ingredient like aggregate also. Synthesis of tungsten carbide nanoparticles by hydrothermal method and its characterization and chemical and structural analysis of gallstones from the Indian subcontinent are described by Sagadevan *et al*. (2017) and Ramya *et al*. (2017). However, our objective of the project is to study and compare the strength behavior of concrete using nylon fiber. Experimental study and investigation of composite coir fiber in disk brake rotor is discussed by Nagarajan *et al*. (2016) (Fig. 1).

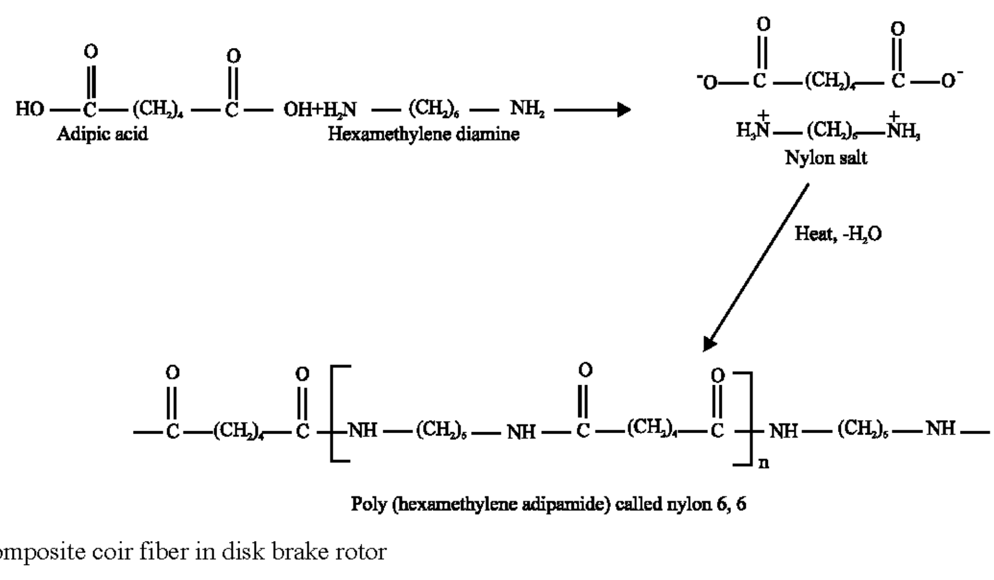

Fig. 1: Composite coir fiber in disk brake rotor

Materials used: M20 grade of concrete was used for casting specimens with the following details:

- Cement-ordinary portland cement (53 grade)
- Fine aggregate-natural sand (river sand)
- Coarse aggregate-crushed aggregate (angular) max size of 20 mm
- Water-tap water
- Fly ash and nylon fiber

MATERIALS AND METHODS

The different diaries were gathered and considered on the nylon fiber and fly powder in concrete by various materials. As per these diaries the procedure of the test and the strategy for the experimentation and the diverse tests directed in those diaries were contemplated and learned. On the premise of the investigations of the diaries gathered for the test the trial philosophy for the venture was pick.

As per the technique took after for the venture, the materials were gathered for the examination, the preparatory tests were led to the materials to know the properties for example, particular gravity, fineness modulus and the water ingestion. In view of these properties the outline blend was done to know the amount of the materials required for the M25 grade concrete.

The examples with the three unique rates of including nylon fibre and fly cinder for example, 5, 10 and 15% and expansion of 1.5% of nylon fiber alongside the control examples. The compressive, split and flexural qualities of the examples were tested.

RESULTS AND DISCUSSION

The mix design was prepared for the M20 grade concrete with adding of fly ash and nylon fiber with various percentages of 0, 5, 10 and 15% and addition of 1.5% nylon fiber. The specimens were cast then tested. The maximum flexural strength for partial replacement of cement with fly ash and nylon fiber is achieved by 20% is found to be greater than the conventional concrete. It reached maximum compressive strength when there is the partial replacement of cement with fly ash and nylon fiber (20%). So, the maximum percentage of replacement of flyash and nylon fiber is 20% (Table 1 and 2; Fig. 2 and 3).

Table 1: Test results cubes for compressive strength

	Average compressive strength (N/mm^2)			
		Fly ash and nylon fiber concrete		
Number of curing days	0(%)	5 and 1.5	10 and 1.5	15 and 1.5
7	20.44	23.72	24.86	27.30
14	24.77	25.90	28.32	32.97
28	31.61	40.67	44.47	44.59

Table 2: Test results beam for flexural strength

	Average compressive strength (N/mm^2)			
		Fly ash and nylon fiber concrete (%)		
Number of curing days	0(%)	5 and 1.5	10 and 1.5	15 and 1.5
7	3.46	2.78	2.85	3.05
14	4.28	3.29	4.32	4.52
28	5.86	5.61	6.53	6.81

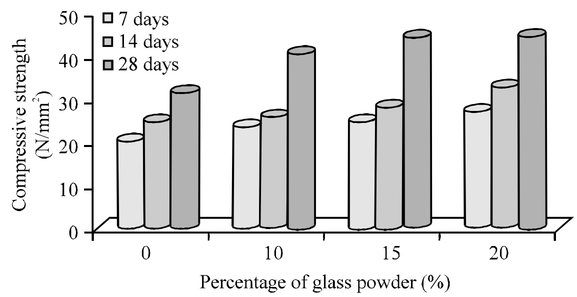

Fig. 2: Compressive strength of cubes (test result of cubes for compression)

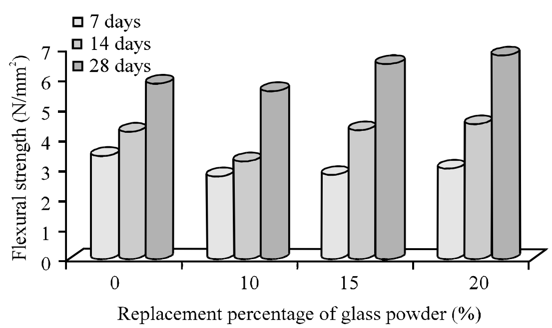

Fig. 3: Flexural strength of beams (test result of beam for flexural strength)

CONCLUSION

Geopolymer concrete without filaments appeared greatest workability. The workability of cement had been found to diminish with increment of fiber content in concrete. It may be because of thick nature of geopolymer concrete and uneven conveyance of strands in the blend. Expansion of steel strands expands the split rigidity. The expansion was noteworthy for blend with 1.5% steel fiber.

Expansion of steel fiber expanded the flexural quality of concrete. The ideal blend rate got was for 1.5% steel by volume. From that point there is no amazing increment in flexural because of diminished workability and lumping of filaments. Compressive quality of HFRGPC increments upto 20% supplanting of steel fiber with polypropylene and after that diminishes. Thus, the ideal substitution rate of steel fiber is 20% by volume. Half breed fiber strengthened cement demonstrated an expansion in flexural quality. The presence of first split was lower at the point when contrasted with SFRGPC. Yet, a definitive flexural quality is higher for HFRGPC. This is expected to the better polypropylene filaments connecting the miniaturized scale break more successfully than the steel filaments.

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