International Journal of Engineering Technology and Management Sciences[IJETMS]

Website: ijetms.in Issue:2, Volume No.2, July-2018 ISSN: 2581-4621(Online)

Study of concrete matrix with N.B.D (Non Bio Degradable) Mixed fibres

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***Abstract*—Accumulation of Non Bio Degradable (NBD) material is increasing day by day and it creates serious problem in the environment. Perhaps the best disposal of NBDs like polythene bags/covers/sheets, disposable plastic glasses, Jute plastic bags and Petro chemical products, is using them as building materials. The use of NBDs as fibers in concrete will reduce the threat to environment and the cost of construction**

Keywords—LLDPE linear low density polyethylene (Polythene bags) , HDPE High density poly ethylene (Jute plastic: Jute plastic is a waste material obtained from cement bags obtained from construction site) , PE(Polyester) polyester is waste material obtained from corrugated sheeting

I. INTRODUCTION

The present work is mainly on studying the properties of concrete using mixed fibers of jute plastics(HDPE), Polythene covers (LLDPE) and polyester with equal proportions in concrete and comparing same with the properties conventional concrete. The experimental work carried out in this regard deals with finding the optimum percentage of NBD mixed fibers to be added to the concrete to prepare fiber reinforced concrete . In the present experimental investigation , NBD mixed fibers have been used up to 4.5% by volume of concrete . An investigation is done on compressive strength split – tensile strength and flexure strength properties of NBD fiber reinforced concrete. Based on the proposed studies, conclusions have been arrived on slight strength improvement of concrete with mixed fibers of NBD.

II. AIM OF PRESENT STUDY

Disposal of NBD i.e., Non- biodegradable material has become a serious problem due to the usage of polymers and other hydro-carbon constituent products like polythene sheets/covers, disposable plastic glasses, jute plastics used as storage containers/ boxes, fibre reinforced plastic sheets and other Petro chemical products in day to day activities which are not biodegradable. While environmentalists see the problem of usage of NBDs as threat to the ecological balance, and campaigning for banning the usage of products made of NBDs in all walks of life. Perhaps a biodegradable substance with same utility characteristics and cost are yet to be discovered to replace NBDs to get rid of the problem. Recycling is found to be the best way by means of segregation NBDs from solid waste and reusing them in some other form. Using NBDs as an alternate material is one of the ways contain further spread of these materials in to the environment. The used up NBD material can be used as fibres in the cement concrete. This will not only contain the threat to environment from NBDs but also result in reducing the cost of construction. To use the NBD waste as building material it should reducing the cost of construction. To use the NBD waste as building material it should be made into small pieces with fixed aspect ratio. NBD waste pieces are then mixed with other constituents to prepare the concrete of appropriate mix. In this project work NBD fibre is recent introduction in making fibre concrete. The NBD mixture(i.e. HDPE, LLDPE and Polyester fibre) with equal proportions used as fibres in concrete, it helps in reducing use of cement but also useful in preventing large scale dumping of plastic waste in to environment.

NBD fibre mixture is used to concrete , the traditional mixes are prone to plastic shrinkage during the setting phase and this can often lead to crazing and cracking. The addition of relatively small amount of fibre reinforcement can effectively eliminate this problem by controlling this early age plastic shrinkage cracking. It also avoids the need for light crack control steel mesh with its attendant disadvantage of handling and positioning. Not only is fibre concrete easy and cost effective to use, but it also enables you to produce a hardened concrete, which has Improved surface quality, Greater impact resistance, Increased damage resistance.

III. HISTORICAL BACKGROUND OF PRESENT STUDY

Poter first put the idea that concrete can be strengthened by the inclusion of fibres forward in 1910.

Since 1950 there has been a dramatic increases in the use of fibre reinforced plastics and this has led to the construction and allied industries to consider the use of more

sophisticated fibbers as reinforcement for cement mortar and concrete. This was further encouraged by promising results published in America by Romulaldi using chopped wire fibres and in Russia by Biryankvich .

The first serious attempt at reinforcing cement and concrete with glass fibre available commercially at the time were severely corroded by the highly alkaline Portland cement matrix, the Russian researchers were unable to produce a composite based on Portland cement and glass fibre, which was satisfactory from the point of view of long term durability. Research carried out in England by building research station in collaboration with Piklington brothers limited has resulted in the development of a new glass fibre, which is inherently alkali resistant because of its chemical composition and is therefore suitable for reinforcing matrices based on Portland cement. This fibre been given the generic name "CEM-Fil" and is now being exploited commercially under license from the national research and development corporation of Britain.

For those looking to cut cost while construction their homes, here is a modest tip. A tip that helps the purse a little bit and puts you on to the environment friendly wagon as well. After a yearlong research have come out saying that Non-Biodegradable (NBD) materials like jute plastic bags used to pack cement, disposable plastic boxes can actually be used as composite material for concrete to save on other composites and also to strengthen the later slightly. This spin-off from NBD waste helps reduce the use of cement and their by cost incurred on the same apart from preventing the large scale dumping of plastic waste into the environment, a problem that has been bugging environmental scientists across the globe. The alternate solution of NBD recycling is considered to be the best way of dealing with NBD plastic waste after segregating it from solid waste reuse in some other form. Use of NBDs as an alternative in road construction is also under testing though it is yet to be commercially promoted.

Use of NBDs as building material is another way to contain spared of these material in to the environment and reducing the cost of construction." Do not throw away all those cement bags made of jute plastic. Instead cut them in to small shreds and mix them along with other regular constituents to prepare concrete. The NBD fibres help in reinforcing concrete and act as crack arrests. NBD material can be used in low cost housing, construction of compound walls, retaining walls and so on. But you should be careful about the measure of NBDs in concrete mixture. As per test results they can be added to the concrete up to 6% by volume .too much of it is not advisable. Thus there will be savings to the extent of 6% of traditional consistence of concrete , not to mention the result savings.

NBDs that can be for the said purpose can vary from all kinds of plastics, jute plastics, to fibre reinforced plastics. The explanation given for the advantage of using these in concrete is that concrete is rich in compression and poor in tension. The reason for the poor strength is the internally present inherent micro cracks. Conventional reinforced concrete has its matrix held together by reinforcing iron bars. On the other hand when it is reinforced by short , closely spaced, uniformly distributed NBD fibres the compressive strength goes up with the NBD fibres acting as crack arresters to a major extant. The behaviour of concrete made of NBD material and conventional one might not be different in many aspects though jute plastic fibres increase the strength to some extent.

IV. EXPERIMENTAL INVESTIGATION

An experimental study is conducted to find out the 28 days compressive strength , split tensile, flexural strength and stress- strain behavior (secant modulus of elasticity) of fiber reinforced concrete. In concrete the addition of fiber (i.e. LLDPE, HDPE and Polyester) in various percentages from 2.25 to 18 volume of concrete. The effect of addition of on strength , workability and durability of concrete over the plain concrete are investigated.

V. PREPARATION OF TEST SPECIMENS

The present experimental study includes costing and testing of specimens for compressive strength , split tension, flexure strength, modulus of elasticity (stress-strain behavior) and durability of FRC specimens are prepared using design concrete mix proportions 1:206:3.55 with Water Cement ratio as 0.55 by weight . the percentage of fibers are used in 0,2.25,4.5,6.75,9,11.25,13.5,18 by volume of concrete have been adopted in the preparation of specimens for each batch of concrete. For mixing pan mixing is adopted throughout the experimental work. ordinary Portland cement of 53 grade available in local market is used in the investigations. The locally available sand is used as fine aggregate for experiment . It is free from clay, silt, organic impurities. machine crushed angular granite metal of 29mm size from the local source is used as coursed aggregate. water used for mixing and curing shall is free from injurious amount of oils , acids , alkalis, salts, sugar, organic materials or other substances.

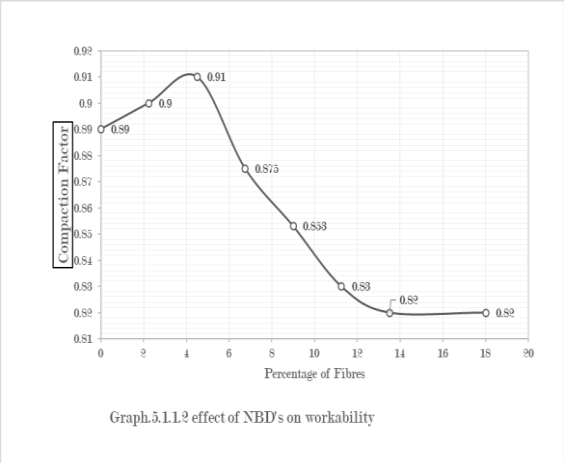
(a) Casting of specimens: For casting the cubes , cylinder and bean specimens a standard cast iron metal mould of size150mmX150mmX150mm,100mmX100mmX100mm, cubes ,1590mm diameter X 300mm height cylinder and 100mmX100mmX150mm beam moulds are used .

Website: ijetms.in Issue:2, Volume No.2, July-2018 ISSN: 2581-4621(Online)

(b) Compaction of concrete: In the present investigation, the internal vibration (needle vibrator) is used for compacting the concrete

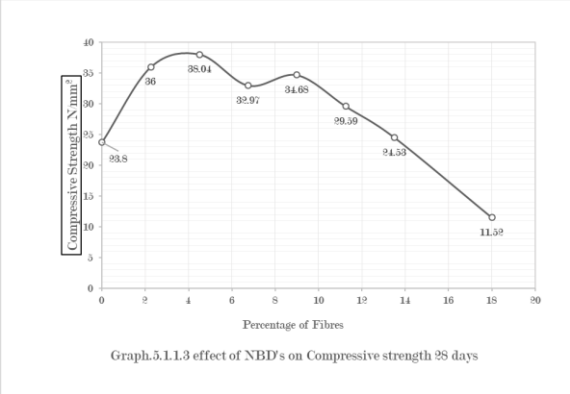
(c) Curing of specimen : After casting the mould specimens are stored in the laboratory free from vibration, ion moist air(at 90% relative humidity) and at a room temperature for 24 hours from the time at addition of water to the dry ingredients. After this period , the specimens are removed from the moulds, immediately submerged in clean fresh water tank. The water in which specimens are submerged, are renewed every seven days and maintain at a temperature of 27± 2^0c. the specimens are cured for 28 days in the present work.

VI. EXPERIMENTAL GRAPHS



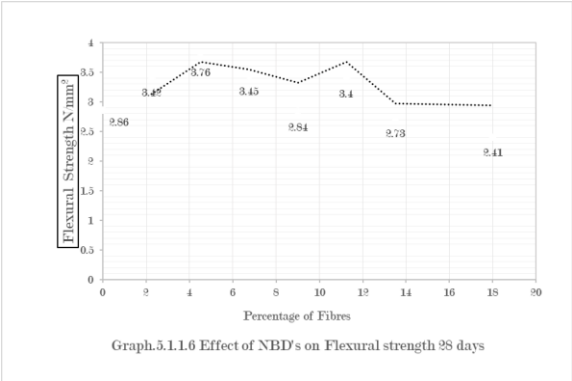
Graph.5.1.1.2 effect of NBD's on workability

A. Graph drawn between Compaction factor and Percentage of fibers



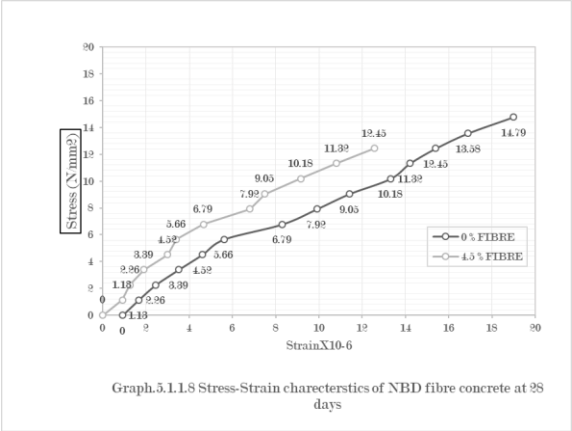
Graph.5.1.1.3 effect of NBD's on Compressive strength 28 days

B. Graph drawn between Compressive strength and Percentage of fibers



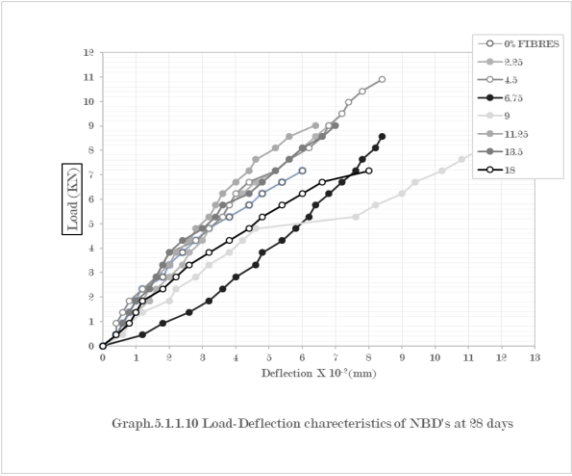
Graph.5.1.1.6 Effect of NBD's on Flexural strength 28 days

C. Graph drawn between Flexural strength and Percentage of fibers



Graph.5.1.1.8 Stress-Strain charecterstics of NBD fibre concrete at 28 days

D. Graph drawn between Stress - Strain characteristics of NBD fiber concrete at 28 days fibers



Graph.5.1.1.10 Load-Deflection charecteristics of NBD's at 28 days

E. Graph drawn between Load and deflection characteristics of different Percentage of fibers

VII. CONCLUSION

(1) The mixture of NBD fibres of LLDPE,HDPE and polyester are improving the concrete properties
Compressive strength by 33.8%
Split tensile strength by 37%
Flexural strength by 65.7%

(2) As the selected fibres are from mixed NBD material, the NBD waste generated from residential and industrial colonies can be used in building constriction for fibre reinforced concrete

(3) The fibres of LLDPE, HDPE, Polyester mixed in concrete at 10% by volume of concrete are not affecting the concrete properties. Hence with disposal aspect 10% of fibres can be mixed in concrete.

(4) The NBD fibre at 4.5% by volume of concrete consumes 25 bags HDPE (Jute plastics), 1.6 Kg LLDPE (polythene covers) and 2.3 Kg polyester per one cum of concrete.

(5) The workability of NBD fibre reinforced concrete slightly decreases with increasing fibre content. Hence minimum of super plasticizer is required to achieve workability.

(6) The additions of NBD fibers reduce the bleeding in concrete and brittle cracks are transformed into ductile cracks, as the fibers adhere to the concrete firmly

VIII. ACKNOWLEDGEMENT

This work was supported by M. Nageswar Rao M.Tech., Assistant professor in Department of civil engineering, L.I.T.A.M dhulipalla and principal and head of the department

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