International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 0056
Volume: 04 Issue: 03 | Mar -2017 www.irjet.net p-ISSN: 2395-0072

FORMULATION AND CHARACTERIZATION OF BIOCRETES

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Abstract - *The development of construction industries provides incogitable benefits to the society and the people. Present scenario in construction field, all around the world was facing a serious problem with price hike of raw materials. So they are very much concerned to reduce the consumption of readily available raw materials. Usage of biocrete is an innovative idea to achieve the requirements. Because of its strength and weight, the rate of construction is quick and the installation becomes easy. The benefits of biocrete are endless, which are strength and weight in turn saves foundation cost, high load bearing strength, high durability and so on. In this project, the bio-concretes are formulated using bio waste materials such as paper mass and waste cloths for various percentages mixed with concrete. The design mix proportion used are 1: 1.5: 3 at which 3%, 5%, 7% of biocrete waste is added with Conventional Concrete,. To study the characteristic properties of bio-concrete such as Cube Compressive Strength, Split Tensile Strength, Flexural Strength and establishing relationship with the strength parameters. All these tests are compared with the control concrete to explore the potential use of these materials in the field.*

Key words: BIOCRETES (Paper mass and Waste cloth), Mechanical properties.

1. INTRODUCTION

The disposal of solid wastes is a major problem around the world. Recycling and use of these waste materials is increasing worldwide, especially in construction fields. In construction industry, the use of recycled materials and wastes is becoming more popular due to shortages of natural mineral resources and increasing waste disposal costs. However, with the use of wastes in engineering applications, a need for further understanding of their engineering behavior is required. The textile cut waste from those industries are usually disposed as waste product which become an environmental nuisance because of it is non-biodegradability, or burned in heaps thus releasing highly toxic fumes in the surrounding air. The most important manufacturing of textile products estimates proximally 40 ton/month of textile trimming waste from the lingerie industry. Synthetic fibers are developed mainly to supply the high demand for textile products. Rayon and Nylon wastes are extremely available. So there are to be recycled and commercialized. Now-a- days, textile fibers are manufactured from a unique type of fiber and from the combination of several fibers such as natural or synthetic, providing a huge variety of final products. Also, Paper is thin sheet of compressed vegetable cellulose fiber. Paper is used for writing and printing, for a wrapping and packaging, and for a variety of special purposes ranging from the filtration of precipitates from solutions to the manufacture for certain types of building materials. Paper is a necessary in modern civilization, and the development of machinery for its high-speed production has been largely responsible for the increase of literacy and the raising of educational levels of people throughout the world. Papercrete is a recently developed construction material which consists of

re-pulped paper fiber with Portland cement or clay and/or other soil added. Although perceived as an environmentally friendly material due to the significant recycled content, this is offset by the presence of cement. However, its strength in modern structures has been proven, and homes and small commercial buildings were being constructed.

2. MATERIALS AND METHODS

2.1. Cement and Aggregates

Ordinary Portland Cement of 43 grade confining to IS 8112 was used throughout the work. The Fine aggregates used throughout the work comprised of river sand with maximum size of 4.75mm conforming to zone II as per IS 383-1970 with a specific gravity of 2.6. Then Coarse aggregates used consisted of machine crushed stone angular in shape and passing through 20mm IS sieve and retained on 4.75mm IS sieve with specific gravity of 2.66.

Table-1: Properties of Cement

S.No.	Property	Cement
1	Initial setting time	41 minutes
2	Final setting time	447 minutes
3	Consistency	30%
4	Specific Gravity	3.13

2.2 Water

A tap water available in the concrete laboratory was used in preparation of concrete. The qualities of water samples are uniform and potable. pH value lies between 6 to 8 and the water is free from organic matter and the solid content should be within the permissible limit as per IS 456 2000 and conforming to IS 3025-1964.

2.3 Paper Mass

First the waste newspaper was cut into pieces (2.5cm x 2.5cm approximately). Then the cut newspaper was soaked in normal tap water in a drum, after two days of soaking in the tap water in a drum. It is taken out from water, then put on the wet grinder for obtaining paper mass. The paper mass was obtained by grinding the waste newspapers by using wet grinder. The grinding was continued till the paper mass turns into a finely divided fiber mass. The paper mass is added by weight of cement.

Fig-1:PaperMass

2.4 Waste Cloth

The textile consists of materials like cotton, polyester, silk and rayon. Then the waste cloth are trimmed into average lengths between 1cm and 2 cm. The cut cloth is washed in detergent powder and dried in direct sunlight. The Waste cloth is added in various percentages by mass of cement.

Fig-2: Waste Cloth

2.4 Batching and Mixing of Materials

Batching of materials was done by weight. The percentage addition of Ordinary Portland Cement (OPC) by **biocretes** were 0%, 3%, 5% and 7%. The 0% addition was to serve as control concrete for other samples.

2.5 Concrete Mix Design

The concrete is used in this research work was made using Binder, Sand and Gravel. The concrete mix proportion was 1:1.5:3 by weight.

2.6 Casting of samples

Cubic specimens of concrete with size 150 mm x 150 mm x 150 mm and cylinder specimens of concrete with size 150 mm x 500 mm and beam specimens with size 100 mm x100 mm x500 mm were casted for determination of all strength. Three mixes were prepared using different percentages of 0%, 3%, 5%, and 7% **biocretes**. The concrete was mixed, placed and compacted in three layers. The samples were demoulded after 24 hours and kept in a curing tank for 28 days as required.

3. RESULTS AND DISCUSSIONS

3.1 Compressive *Strength Test*

Table-2: Compressive Strength of Concrete with Paper mass and Textile waste

Addition of equal parts of Paper mass and Textile waste	Compressive strength (fck) N/mm^2		
	7th day	14th day	28th day
0%	16.53	21.39	28.13
3%	17.3	23.24	29.35
5%	**19.23**	**25.54**	**30.45**
7%	15.5	23.2	27.8

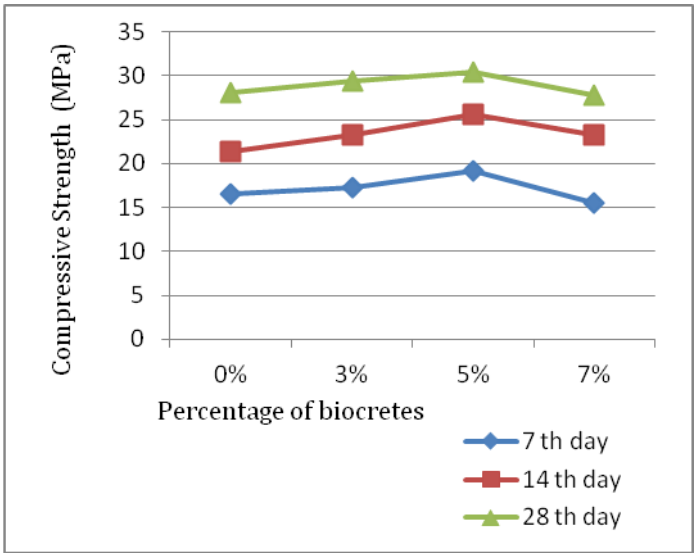

Chart-1: Compressive strength for various mix proportions of biocretes at 7th and 14th and 28th day test

In 7 days curing, the compressive strength value for the control concrete was 16.3 MPa and biocretes-5% was 19.23 MPa and beyond this percentage of adding of biocrete concrete, strength was gradually reducing and reaching 15.5 MPa for 7% addition of biocrete.

In 14th day curing, the compressive strength value for the control concrete was 21.39 MPa and biocretes-5% was 23.24 MPa and beyond this percentage of adding of biocrete concrete, strength was gradually reducing and reaching 23.2 MPa for 7% addition of biocrete.

Similarly In 28th day curing, the compressive strength value for the control concrete was 25.13 MPa and biocretes-5% was 30.45 MPa and beyond this percentage of adding of biocrete concrete, strength was gradually reducing and reaching 27.80 MPa for 7% addition of biocrete. The reason for such variation for the first 5% is due to the presence of the calcium oxide in biocretes and excess amount of biocretes do not react with fine aggregate and therefore gradual reduction in strength was occurred with increasing the percentage.

3.2 Split Tensile Strength Test

Table-3: Tensile Strength of Concrete cylinder with Paper mass and Textile waste

Addition Of Equal parts of Paper mass and Textile waste	Split tensile strength of concrete (fck) N/mm^2		
	7th day	14th day	28th day
0%	1.21	1.46	1.84
3%	1.28	1.54	1.72
5%	1.32	1.65	1.93
7%	1.15	1.27	1.55

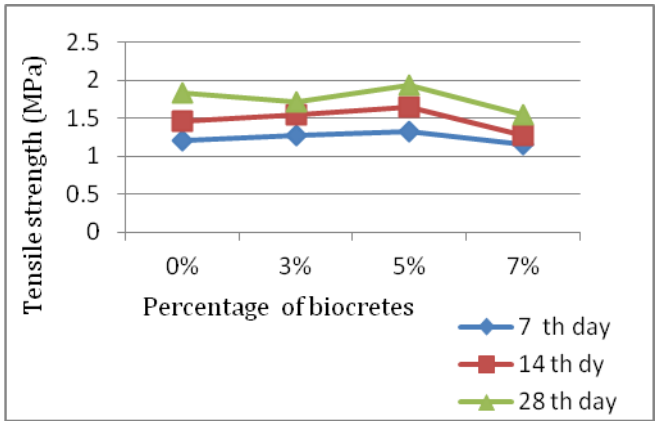

Chart-2: Split tensile strength for various mix proportions of biocretes at 7th and 14th and 28th day test

In 7 days curing, the tensile strength value for the control concrete was 1.21 MPa and biocretes-5% was1.32 MPa and beyond this percentage of adding of biocrete concrete, strength was gradually reducing and reaching 1.15 MPa for 7% addition of biocrete.

In 14th day curing, the tensile strength value for the control concrete was 1.46 MPa and biocretes-5% was 1.65 MPa and beyond this percentage of adding of biocrete concrete, strength was gradually reducing and reaching 1.27 MPa for 7% addition of biocrete.

Similarly In 28th day curing the tensile strength value for the control concrete was 1.84 MPa and biocretes-5% was 1.93 MPa and beyond this percentage of adding of biocrete, strength was gradually reducing and reaching 1.55 MPa for 7% addition of biocrete. The reason for such variation for the first 5% is due to the presence of the calcium oxide present in biocretes and excess amount of biocretes does not react with fine aggregate and therefore gradual reduction in strength was occurred with increasing the percentage.

3.3 Flexural Strength Test

The Flexural strength of cement concrete with different percentage of Paper mass and textile waste is given below.

Table-4: Flexural Strength of Concrete beam with Paper mass and Textile waste

Addition of Equal parts of Paper mass and Textile waste	Flexural strength of concrete (fck) N/mm^2	
	14th day	28th day
0%	3.8	5
3%	4.2	5.5
5%	**4.7**	**6**
7%	4.3	5.7

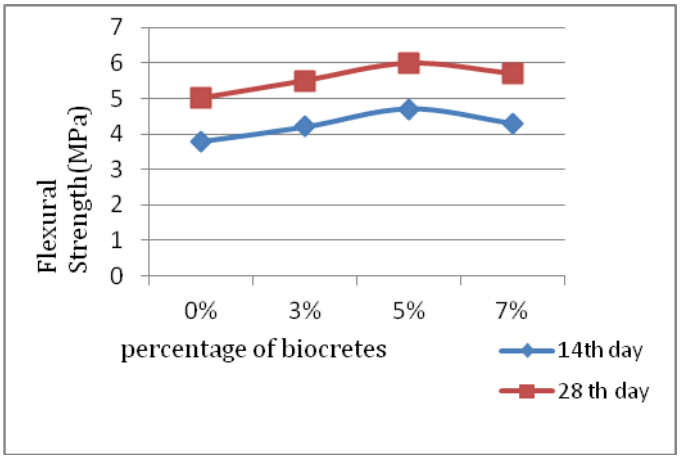

Chart-5: Flexural strength for various mix proportions of biocretes at 14th and 28th day test

In 14th day curing, the flexural strength value for the control concrete was 3.8 MPa and biocretes-5% was 4.7 and beyond this percentage of adding of biocrete, strength was

gradually reducing and reaching 4.3 MPa for 7% addition of biocrete.

Similarly In 28th day curing the flexural strength value for the control concrete was 5 MPa and biocretes-5% was 6 MPa and beyond this percentage of adding of biocrete, strength was gradually reducing and reaching 5.7 MPa for 7% addition of biocrete. The reason for such variation for the first 5% is due to the presence of the calcium oxide in biocretes and excess amount of biocretes does not react with fine aggregate and therefore gradual reduction in strength was occurred with increasing the percentage.

4. CONCLUSION

The compressive strength, tensile strength and flexural strength of concrete achieve the target strengths up to 5% addition of biocretes with cement. Further addition of biocretes with cement there is a decrease in the compressive strength and tensile strength and flexural strength.

The decrease in compressive, tensile strength and flexural strength with the increase in percentage of biocretes was due to the presence of low silica content in the composition which tends to decrease its strength. There was an increase in water absorption of the concrete mixes as the content of the biocrete is increased.

Hence the optimum amount of biocretes was found to be 5% and this leads to the less pollutant concrete without compromising the strength. Then increasing amount of addition of biocretes

Waste with cement which is leads to decreasing the strength. So does not take above 5 % of biocretes waste with addition of cement for future work.

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