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Partial Replacement of Natural Sand by Bakelite Powder in Concrete Cubes

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Abstract-

Construction is the major part of everyday life. It requires all the construction material which mainly includes cement and sand. Cement provides the basic strength to the building. The manufacturing of cement is a major issue as it involves pollution on a large level as well as cost of construction also increases. This cement can be replaced by a construction material called fly ash. Sand provides bulk, strength and other properties to the building.

Sand is a granular material composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarse than silt. Sand can also refer to a textural class of soil or soil type; i.e., a soil containing more than 85 percent sand-sized particles by mass.

The composition of sand varies, depending on the local rock sources and conditions, but the most common constituent of sand in inland continental settings and non- tropical coastal settings is silica (silicon dioxide, or SiO_2), usually in the form of quartz. The second most common type of sand is calcium carbonate, for example, aragonite, which has mostly been created, over the past half billion years, by various forms of life, like coral and shellfish. For example, it is the primary form of sand apparent in areas where reefs have dominated the ecosystem for millions of years like the Caribbean.

Key Words – **Natural sand, Bakelite powder, Strength, Concrete cubes, Compressive strength**

1.INTRODUCTION

Construction material is the major part of everyday construction. It requires all the construction material which mainly include cement and sand. Cement provides the basic strength to the building. The manufacturing of cement is a major issue as it involves pollution on a large level as well as cost of construction also increases. This cement can be replaced by a construction material called fly ash. Sand provide bulk, strength and other properties to the building.

Sand is a granular material composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarser than silt. Sand can also refer to a textural class of soil or soil type; i.e., a soil containing more than 85 percent sand-sized particles by mass.

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Sand is a non-renewable resource over human timescales, and sand suitable for making concrete is in high demand. Desert sand, although plentiful, is not suitable for concrete, and 50 billion tons of beach sand and fossil sand is needed each year for construction.

1.1 USE BAKELITE AS A BUILDING MATERIAL

The purpose of this research is the use of waste Bakelite aggregate milling machine for Bakelite waste size reduction and use of the post-milling waste Bakelite as a fine aggregate to replace natural sand material in concrete. The concrete sample was tested for compressive strength follow ASTM standard. The compressive test result of concrete samples will be compared between conventional mortar (0% WBFA) and waste Bakelite mortar (WBM) as well as comparing with the mortar standard. From an analysis of the sample test data found that the WBFA content in concrete mixture can predict the strength of WBM.

1.2 Objective

(1) To find alternative building material

(2) To find strength of concrete block at various proportion

(3) To use Bakelite as a building material

(4) To reduce the dumping problem of Bakelite

2.LITERATURE REVIEW

(1)-S.Sakthi Sasmitha, Dr.R.N.Uma "A Critical Review on the Application of Bakelite as a Partial Replacement of Fine and Coarse Aggregate", International Journal for Scientific research & development, Volume 4 Issue 11 –NOVEMBER 2018, ISSN [ONLINE]: 2395-10521[1];

This study describes about the basic concept and application of Bakelite which is made into different forms of construction material. In order to reduce the waste management problem created by disposal of waste Bakelite into direct land filling and open burning, this study reveals the use of Bakelite as fine aggregate as well as coarse aggregate in construction field. Bricks, Paver Blocks & Solid Blocks are manufactured using waste Bakelite as a partial replacement of fine and coarse aggregate. Tests are conducted to examine its strength and compared with conventional material.

The present study reveals the properties and use of Bakelite as a construction material in bricks, paver blocks, and solid blocks with appropriate specifications. The use of waste material into construction industry creates a challenging job and better performance along with the development of construction sector. Incorporation of plastic waste in building material gives a cost effective and light weight sustainable component in construction which alters the strength and durability property. This study helps to develop a replaceable material (waste Bakelite) for fine and coarse aggregate in order to minimize disposal of plastics which creates a waste management problem.

(2)-Nopagon Usahanunth, Seree Tuparakay "The transformation of waste bakelite ro replace natural fine aaggregate in cement mortar",Open article published by Elseweir.ltd. in 2017,www.elsevier.com/locate/cscm[2]

Highly functional plastic products centering on phenol resin products are used in various automobile-related products due to the outstanding properties achieved by its strong network bridge structure, such as high heat resistance and excellent chemical resistance. In particular, glass fiber-reinforced molding materials excel in strength, rigidity, dimensional stability, and reliability and are used in various elements of mechanisms such as a pulley, disk brake pistons, and water pumps

The objective of this study is a transformation of waste Bakelite from industrial manufacturing by size reduction with the milling machine. The smaller size of waste Bakelite will be classified into coarse aggregate and fine aggregate by sieve.

In this paper, the studying will focus on the transformation of waste Bakelite and the utilization of waste Bakelite fine aggregate (WBFA) as natural fine aggregate (NFA) replacement in a cement mortar. The milling capacity, the gradation of waste Bakelite fine aggregate grain size was analyzed, and illustrated by particle size distribution curve.

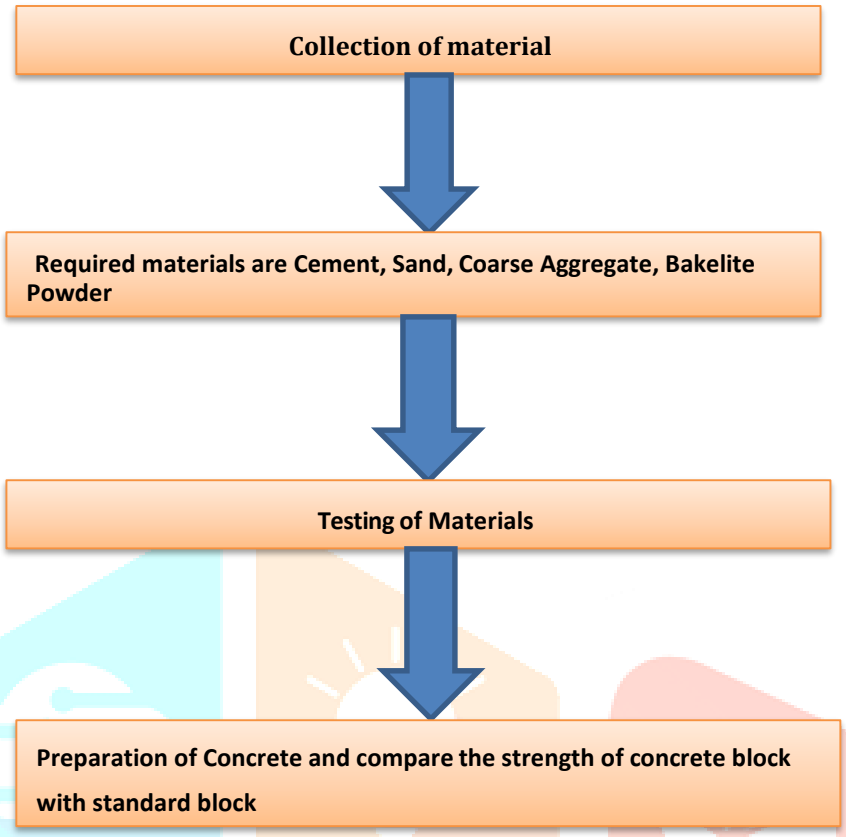
(3)- Lalith Prasanth.R, Gopalakrishnan.S, Thanigainathan.G, Kathiravan A. "Utilization of Waste Plastics in Flyash Bricks", International Journal of Pure and Applied Mathematics, Volume 119, No.15 2018, 1417-1424, ISSN: 1314-3395[3].

They utilized fly ash bricks with a combination of powdered plastics which is added as 5%, 10%, 15%, 20%. Raw materials used are Class F Flyash, Quarry dust, lime, waste plastic powder and water. Test results indicated that the compressive strength increases with increase in percentage of powdered plastic added. Moreover, there is a decrease in percentage of water absorption as the addition of plastic and there is a nil formation of white patches as per the result of efflorescence test. From this study, it was revealed that the partial replacement of plastic for quarry dust decreased the weight of brick and it can be effectively used in construction field.

(4)- S. Alan, B.Sivagnanaprakash, S.Suganya, A.Kalaiselvam, V.Vignesh. "A Study on Mechanical Prop--erties of Fly ash Brick with Waste Plastic Strips", International Journal of Applied Engineering Research, ISSN 0973-4562 Vol. 10 No.53 (2015)[4]

They investigated the properties of fly ash brick with waste Plastic Strips. The amount of plastic waste added is varies from 0% to 2% with an interval of 0.5%. Polyethylene tetra phthalate (PET) is added as a plastic in the manufacturing of fly ash brick by varying the amount of percentage added and with a dimension of 220 mm x 115 mm x 70 mm. From the test results, the compressive strength is optimum at 1% replacement of PET whereas in impact test; no bricks of any sample are forced to break while other clay bricks have been broken into two or more pieces. But there is a drastic change in water absorption test, only 2% absorption is yielded. From this it was known that Polyethylene tetra phthalate bricks are comparatively better than conventional brick and an economical product in construction field.

3.METHODOLOGY-



4.MATERIAL

4.1Cement-

In this project we use the ordinary PPC(Portland pozzolana Cement) cement. Portland- pozzolana cement is produced by grinding together Portland cement clinker and artificial pozzolana (Fly ash) with addition of gypsum or calcium sulphate

Fig-1 Cement

4.2 SAND-

Sand derived from a rock, in which the grains separate along their natural boundaries. This includes unconsolidated sand or a soft sandstone where little pressure is required to separate the individual grains.

Fig-2 Natural Sand

4.3 BAKELITE POWDER-

Bakelite powder of the synthetic resins probably the best known and most widely employed is Bakelite. This is produced by a reaction between phenol (carbolic acid) and formaldehyde, a product of wood distillation.

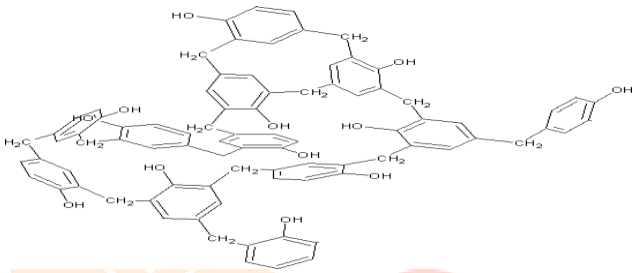


Fig-3 Bakelite

4.4COASRE AGGREGATE

Coarse aggregate is defined as rock particles with diameter more than 4.75 mm, usually called gravels. Commonly-used coarse aggregates in concrete are gravels and pebbles.

Fig-4 Coarse Aggregate

4.5WATER-

Potable tap water available in laboratory with pH 7.0 and confirming to requirement of IS 456-2000 was use for mixing concrete and curing the specimen as well.

5.TEST-

5.1 TEST FOR AGGREGATE

Crushing test

Impact test

Water absorption test

5.2 TEST FOR CEMENT

Fineness test

Consistency test

Setting Time test

Specific gravity test

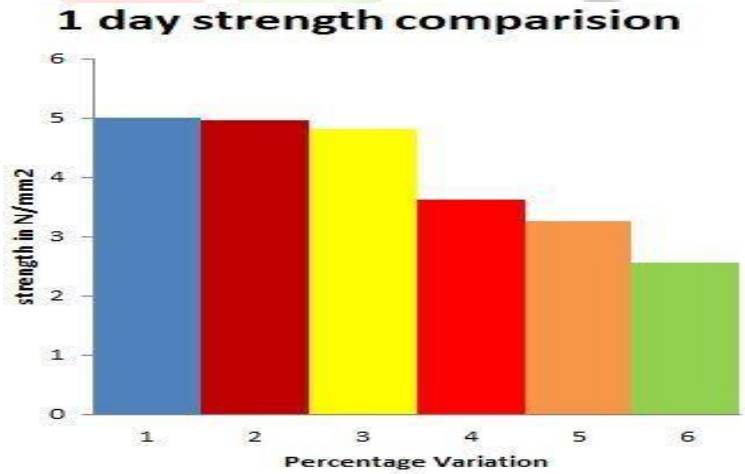
5.3 TEST FOR CONCRETE

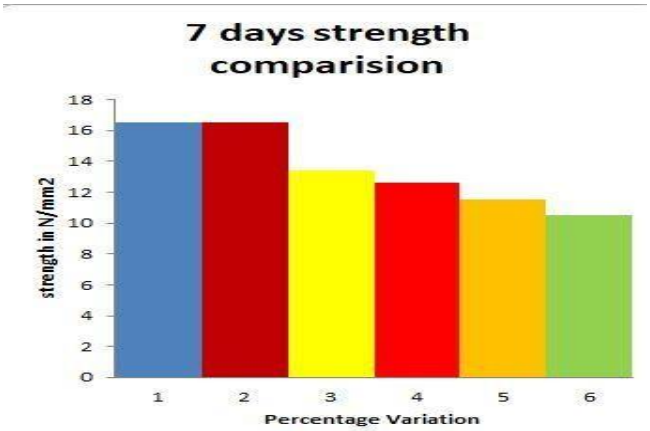
Slump test

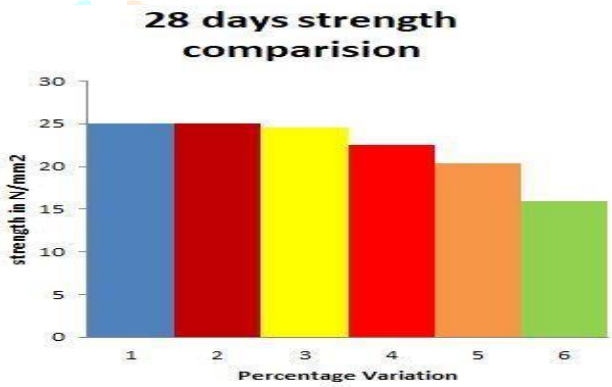
Compressive strength test

6.RESULT-

Compressive strength test-







7.CONCLUSION-

1. Fine aggregate replacement by brick kiln dust showed strength ranging from 24.51Pa to 25 MPa for 0% to 10% Bakelite powder content.
2. The optimum result is found to be after replacement of Bakelite powder
3. Strength of concrete with Bakelite powder replacements at optimum ratio was tested to be 24.51 MPa
4. This concrete can be used up to 3 floor house/buildings, surface water tanks and for structure of aesthetic value.
5. High quality control with respect to material and casting is required for this type of concrete manufactures.

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CONCRETE MIX DESIGN PROCEDURE