

PERFORMANCE EVALUTION OF WASTE MATERIAL IN CONCRETE: - A Review

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ABSTRACT

Currently in India the development is at its peak point and it developing the infrastructure like Express way, power projects, industrial structure, mega buildings, etc. to meet the globalization in the construction of buildings and other structure. Concrete plays the key role and a large quantum of concrete is being utilized in every construction practices. Fine aggregate is one of the important materials for the preparation of concrete. It is obtained from the river. However due to increased use of concrete in construction work, the demand of fine aggregate is increased. To attain the demand of natural sand in concrete, partial or full replacement of fine aggregate with some waste material like: Quarry dust, stone dust, marble powder, recron 3S fiber, hypo sludge etc. is the effective methods. In this paper analyze the effect of waste material on mechanical properties of concrete. The objective of this paper is to review the evaluation of various waste materials in concrete

Keywords : Concrete, Fine aggregate, Hypo sludge, Marble powder, Recron 3S fiber, Stone dust, Quarry dust.

I. INTRODUCTION

Concrete is the most common material in building construction. As the consumption of concrete increases, the demand of its component also increased. Requirement of fine aggregate is achieved from the river sand. Excess extraction of river sand from the bank of river may damage river ecosystem. On the other hand, to reduce the environmental load there should be alternate materials of fine aggregate in concrete. Researchers showed that river sand can be replaced by using quarry dust, stone dust, marble powder, recron 3S fiber, as give comparable strength.to concrete. Quarry dust is a waste obtained during quarrying process. It has very recently gained good attention to be used as an effective filler material instead of fine aggregate. The hardened and durable properties of concrete using quarry dust were investigated. Also, the use of quarry dust as the fine aggregate decreases the cost of concrete production in terms of the complete replacement for natural river sand. Stone dust has somehow similar or better mechanical properties to fine aggregate. Using of stone dust is also beneficial from the environmental aspect. Marble is a metamorphic rock resulting from the transformation of a pure limestone. The purity of the marble is responsible for its colour and appearance: it is white if the limestone is composed solely of calcite (100% CaCO₃). A large quantity marble powder is generated during the cutting process. This unattended mass of marble waste consisting of very fine particles is today one of the environmental problems around the world. The replacement of natural sand with marble powder sand is economic alternative.Recron-3s is a fiber material. It is a by-product of fuel Extraction at Jamnagar, Gujarat. It is mainly used to prevent dampness and leakages. And it is used as the reinforced material. Hypo sludge is a solid waste from paper

industries. Hypo sludge is the primary waste material from the paper industry. It consists of cellulose fibers, calcium carbonate, silica, magnesium, calcium chloride, china clay and residual chemicals along with water. The presence of silica, magnesium and calcium in hypo sludge makes it similar to that of cement and hence there is a possibility to replace cement with hypo sludge. The Hypo sludge can minimize the demand for cement and reduce the cost of construction. The chemical properties of Hypo sludge are:-

Constituents	%
Lime	49
Silica	5.5
Alumina	2
Magnesium	1.6
Sodium oxide	1.6
Potassium oxide	1.6

II. LITERATURE REVIEW :

Utkarsh K. Yadav, et. Al (2016) has studied the “Effect of the stone dust on mechanical properties of concretes”. In this paper they shows some relevant studies regarding the effect of stone dust on mechanical properties like compressive strength, tensile strength, flexural strength, acid attack resistance, sorptivity etc. of concrete. Studies shows that stone dust can be used as an alternate material for natural sand to some extend for the preparation of concrete hence, in this paper, strength properties of conventional concrete and stone dust concrete are compared. This literature shows that many researchers have conducted many experiments on stone dust as a replacement material for fine aggregate. All the researches show the definite effect on the property of concrete. Following significant points can be concluded form their study:

1. Concrete shows higher compressive strength after replacing fine aggregate by stone dust. So the stone dust can be used as an additive in concrete preparation.
2. Workability of concrete increases with the use of stone dust.
3. Stone dust can be used as an alternate material of fine aggregate both in lean concrete as well as in high strength concrete. It is reported in this paper that stone dust increases the strengthen properties of concrete. However other parameters like temperature, humidity, climate conditions, air-entrapped etc. also affects the same.

Pooja J.Chavhan et. Al. (2014) has studied the “Behavior of marble powder as supplementary cementitious material in concrete”. In this paper marble powder is replace by sand the research is carried out by using M25 grade concrete with replacement of 0% , 5% , 10% , 15% , 20% , 25% , 30% , 35%, 40%, 45%, 50% marble

powder by sand and is carried out to determine the optimum percentage of replacement at which maximum compressive strength and also split tensile strength is achieved. There are several reuse and recycling solutions for this industrial by-product, both at an experimental phase and in practical applications. These industrial wastes are dumped in the nearby land and the natural fertility of the soil is spoiled. The physical, chemical and mechanical properties of the waste are analyzed. In this paper the following conclusion can be drawn:

1. Compressive strength increases with increase of marble powder.
2. Compressive strength increases with 30% replacement and also 45%,50% replacement by sand
3. The maximum 28 days split tensile strength was obtained with 45% marble powder replaced with fine aggregate.
4. We have put forth a simple step to minimize the costs for construction with usage of marble powder which is freely or cheaply available; more importantly.
5. We have also stepped into a realm of saving the environmental pollution by cement production; being our main objective as Civil Engineers.
6. Marble slurry utilization in black cotton soil is one of the best ways to improve soil properties and to protect the environment up to some extent from the harmful effects of disposal of marble slurry in land and water.

Dharani.N et. Al. (2013) has studied “Experimental investigation on mechanical properties of recron 3S fiber reinforced hypo sludge concrete”. In this paper they study the various mechanical properties of concrete containing hypo sludge and Recron 3s fibres. Hypo sludge was used as a replacement to cement. Replacement percentages used during the study were 10%, 20%, 30%, 40%, 50%. For each replacement percentage of cement with hypo sludge 0.2%, 0.3%, 0.4% of Recron 3s fibres were added and specimens were cast to determine the mechanical properties. Compressive strengths of cubes were found on the 28th day. The 28th day split tensile strength of the specimens was found on the cylinders. The flexural strength of the specimens was found on the 28th day. It is found that addition of hypo sludge and Recron 3s fibres have beneficial effects on the mechanical properties of concrete. The conclusion of this paper is that the optimal replacement percentage of cement with hypo sludge is found to be 30% when Recron 3s fibers are not added. On addition of Recron 3s fiber with cement matrix, the compressive strength and split tensile strength decrease with increase in fiber content, however the flexural strength increases with increase in fiber content. When hypo sludge and Recron 3s fiber are added, the optimum dosage of Hypo sludge is 20% and optimum Fiber content is 0.4%. The usage of Hypo sludge will reduce the ill effects on the environment caused due to the disposal of sludge. Usage of Recron 3s fibers will reduce the cost of maintenance by reducing the micro cracks and permeability and hence the durability will increase. It is found that use of Recron 3s fibre reduces the segregation.

A.Sivakumar et. Al. (2011) has studied the “Characteristics studies on the mechanical properties of quarry dust addition in conventional concrete”. This paper reports the experimental study which investigated the influence of 100% replacement of sand with quarry dust. Initially cement mortar cube was studied with various proportions of quarry dust (CM 1:3, CM 1:2 and CM 1:1). The experimental results showed that the addition of quarry dust for a fine to a coarse aggregate ratio of 0.6 was found to b enhanced the compressive properties as well as elastic modulus. The analysis of experimental data 0.2%, 0.3%, 0.4% of Recron 3s fibres were added and specimens were cast to determine the mechanical properties. Compressive strengths of cubes were found on the 28th day. The 28th day split tensile strength of the specimens was found on the cylinders. The flexural strength of the specimens was found on the 28th day. It is found that addition of hypo sludge and Recron 3s fibres have beneficial effects on the mechanical properties of concrete. The conclusion of this paper is that the optimal replacement percentage of cement with hypo sludge is found to be 30% when Recron 3s fibers are not added. On addition of Recron 3s fiber with cement matrix, the compressive strength and split tensile strength decrease with increase in fiber content, however the flexural strength increases with increase in fiber content. When hypo sludge and Recron 3s fiber are added, the optimum dosage of Hypo sludge is 20% and optimum Fiber content is 0.4%. The usage of Hypo sludge will reduce the ill effects on the environment caused due to the disposal of sludge. Usage of Recron 3s fibers will reduce the cost of maintenance by reducing the micro cracks and permeability and hence the durability will increase. It is found that use of Recron 3s fibre reduces the segregation.

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III. CONCLUSIONS

This literature shows that many researchers have conducted many experiments on waste products and other materials as a replacement material for conventional concrete. All the researches shows the definite effect on the property of concrete. Following significant points can be concluded from their study.

- Concrete shows higher compressive strength after replacing fine aggregate by stone dust
- Workability of concrete increases with the use of stone dust.
- Compressive strength increases with increase of marble powder
- Marble slurry utilization in black cotton soil is one of the best ways to improve soil properties and to protect the environment up to some extent from the harmful effects of disposal of marble slurry in land and water.
- On addition of Recron 3s fiber with cement matrix, the compressive strength and split tensile strength decrease with increase in fiber content, however the flexural strength increases with increase in fiber content.
- Usage of Recron 3s fibers will reduce the cost of maintenance by reducing the micro cracks and permeability and hence the durability will increase.
- It is found that use of Recron 3s fibre reduces the segregation.
- The fine quarry dust tends to increase the amount of super plasticizers needed for the quarry mixes in order to achieve the rheological properties.
- When the quarry dust has high fineness, its usage in the normal concrete is limited because it increases the water demand.

REFERENCES

1. Yadav Utkarsh K., Mahar P.S., Verma V.K.(2016). Effect of stone dust on mechanical properties of concretes: a review International Journal For Technological Research In Engineering Volume 3, Issue 9, May-2016
2. Chavhan Pooja J., Prof. S.D. Bhole(2014). To study the behavior of marble powder as supplementary cementitious material in concrete. Int. Journal of Engineering Research and Applications ISSN : 2248-9622, Vol. 4, Issue 4(Version 1), April 2014, pp.377-381
3. Dharani.N, Ashwini.A, Pavitha.G, Prince A.rulraj.G(2013). Experimental investigation on mechanical properties of recron 3s fiber reinforced hypo sludge concrete.International Journal of Civil Engineering Volume 4, Issue 1, January- February (2013), pp. 182-189
4. Sivakumarand Prakash M.(2011). Characteristic studies on mechanical properties of quarry dust addition in conventional concrete ISSN 2141-2634 ©2011
5. Abbas S.Y., Srivastava V. & Agarwal V.C. "Effect of stone dust on compressive strength of concrete an experimental investigation". International Journal of *Engineering Science & Research Technology*, vol. 4(2), pp. 538-543. 2015.

6. M.S. Hameed, A.S.S. Sekar, *Properties of green concrete containing quarry rock dust and marble sludge powder as fine aggregate. India, ARPN Journal of Engineering and Applied Sciences 4 (4) (2009) 83–89.*
7. H.S.Chore, P.A.Dode, and N.L.Shelke, “*Compressive strength of Fiber Reinforced Fly-Ash Concrete Using Regression Model*”, in *International Conference on Advanced Science, Engineering and Technology, 2011, 602-606.*