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Effect of Limestone and Wooden Dust as a Filler Material on Fresh and Hardened Properties of Concrete

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Abstract: ***In this project main objective is to study the partial replacement of the Limestone and Wooden Dust with the varying proportion in the concrete and to check the different properties of the concrete by comparing with the normal concrete. The replacement of Fine aggregate (sand) with certain wooden dust in concrete that makes the structure more light in weight mean while we are going to replace the limestone as in place of coarse aggregate in the concrete so make it more compacted with the small aggregates. The Workability, strength and durability test are studied in this project. The most important properties of concrete is the compressive strength. Also, increasing the limestone and the wooden dust incorporation caused decreases in unit weights and compressive strength values of mortars with a parallel increase in water absorption values at all ages.***

Keywords: Wooden dust, limestone, strength, properties and absorption

1. Introduction

Concrete Technology

Over recent years a rapid development in the field of concrete technology has taken place. Concrete has become the most popular construction material. Even common people have started using concrete in a big way. Its popularity and ease with which it can be prepared, has led to many innovations in the field of concrete. Earlier we were thinking of M-20 grade concrete only today we are producing well above M-60.Thus, based on natural minerals aggregate it is now possible to produce concrete with compressive strengths of up to 230 MPa. If natural mineral aggregate is replaced by high quality ceramic aggregate, compressive strengths upto 500 MPa can be achieved. Also over recent years however many relatively new concrete structures and industrial products have shown a poor performance. It is great challenge, therefore both to utilize and apply and also further develop existing technology on high performance concrete to the benefit of both the concrete industry and the society.

In recent study many new material are use as a partial replacement material in concrete which can increase its properties of the concrete such material as limestone, marble dust, wooden husk, rice husk etc.

Limestone

One of the major achievements of the cement and concrete industries during the past years is the increasing use of mineral additions. The high cost of energy, diminishing energy sources in the world and the greenhouse effect require that energy consumption be reduced by all industries. The benefits of addition of supplementary materials to Portland cement are well documented.

During the early age the use of the limestone instead of cement where done to construct the building and that gave some strength to it. But after that cement come into play for the limestone. Limestone is a familiar material in the construction industry. Nowadays limestone is mainly use as a decorative material in various types of buildings (residential). Most of the limestone waste is generated during cutting large stone to smaller desire shape.

The addition of limestone reduces the initial and final setting time, as well as porosity, whereas free lime and combined water increase with increasing limestone content. The quality of the limestone filler affects the performance of the cement in concrete and the water demand of the cement.

Most of the limestone dust can be used as an additive in concrete mixes to improve the strength at early stage. Limestone is naturally available, cheap and it basic raw material in many industries. Finely powdered limestone helps into reducing water demand and segregability mixture to increase their water holding capacity plasticity and homogeneity of mortar and reduce shrinkage.

Source: (http://rajasthan.all.biz/ar/alhgr-algiri-g69177)

Wooden dust

Saw dust is also known as wooden dust. It is the by-product of cutting, drilling wood with a saw or any other tool it is composed of fine particles of wood, certain animals, birds and insects which live in wood such as carpenter ant are also responsible for producing the wooden dust. It is produced as a small discontinuous chips or small fragments of wood during sawing of logs of timber into different sizes.

Source: (http://www.transgreens.com/saw-dust.htm)

Saw dust concrete consist of roughly equal parts by volume of Portland cement, sand and pine saw dust, with water to give a slump of 25 to 50 mm. it bonds well to ordinary concrete and is a good insulator.

Saw dust from tropical hardwood has used to make sawdust concrete with a 28 days compressive strength of 30 Mpa and a spitting strength of 2.5 mpa the concrete has density of 1490kg/m^3

2. Objective and Scope

The main objective and scope of this study is given as. This has economical benefits because concrete uses large amount of the limestone which are used as the replacement of coarse aggregate with certain proportion of natural aggregate in concrete. Several tonnes of the limestone and wooden dust are generated every year and it should be disposed every year. Investigate the performance of wooden dust as partial replacement of sand and to reduce the overall construction cost and to minimize the environmental issues created due to use of excessive sand. The scope of this paper is to make the concrete as light in weight with less cost and can have the maximum strength with the environmental free pollution. To over sees and inspect the performance of fresh and hardened properties of the concrete.

From the study of the research papers it shows that replacement of material increases some of the compressive strength increases. The number of the combination of the concrete mixes are produced by replacement of the finer aggregate (sand) with the varying proportion of the wooden dust and the another replacement of the coarse aggregate (kapchi + grit) with limestone to develop the mix design for concrete. Experimental investigation on the utilization of the wooden dust and the limestone with plasticizer in different proportion and study its influence on parameters like strength and durability of concrete. Tests for research work has been restricted to Compressive strength test, Split tensile strength test, Durability test by Water Absorption and Acid Resistance, of M20 grade concrete with P.P.C cement**.**

3. Research Paper

Dr. Muyasser M. Jomma'h at all in his research work he has taken three different sample of limestone from three different places and replaced in place of coarse aggregate with varying proportion for the 3, 7 and 28 days. The average compressive strength of the three samples are tested and found that Himreen, Makhol and Al sinea has the compressive strength of 19.20Mpa, 28 Mpa and 32.11 Mpa. The Al-sinea limestone type is considered as a good alternative of coarse aggregate in concrete mix to get light weight concrete.

Hafez E. Elyamany, Abd Elmoaty M. And Elmoaty, Basma Mohamed at all has used two different fillers pozzolanic (silica fume, Metakaolin) and non pozzolanic (Limestone granite dust, marble dust) and filler type pozzolanic has significant effect on segregation resistance and bleeding resistance but non pozzolanic decreases and for flow-able concrete the water absorption reduces 10% as compared to flow-able hardened concrete. There is no negative effect of non-pozzolanic effect on compressive strength as compared to pozzolanic effect.

Hafez E. Elyamany, Abd Elmoaty M. And Elmoaty, Basma Mohamed at all states that with 100% crushed recycled

aggregate gives the strength of 53.4 Mpa and 100% crushed limestone gives 38.7 Mpa. The absorption in mix with 100% crushed concrete and limestone are greater than that with 100% natural aggregate concrete about 54% and 74%. The crushed limestone aggregate reduces the modulus of elasticity according to the percentage.

Omar M. Omar, Ghada D. Abd Elhameed, Mohamed A. Sherif, Hassan A. Mohamadien at all provide by using limestone waste with 50% replacement increases compressive strength about 12% at 28 days and by increasing cement content increased about 6 % at 28 days more way tensile strength and flexural strength increases about 17% and 8%.

Dr T. N. Boob at all stated that the 1:6 cement sand mix with 15% saw dust gives 4.5 N/mm2 which is reasonable meanwhile density of block reduces and the water absorption capacity also increases with increase in % saw dust and larger amount of water may reduce the strength.

4. Material and Methods

Cement
The PPC cement is used in this project is manufactured by inter-grinding of OPC clinker with 10 to 25 percent of pozzolanic material. 25% of the Fly ash is used in the PPC. Technically PPC has considerable advantages over OPC when made by using optimum percentage of right quality of fly ash.

Advantages
a. In PPC costly clinker is replaced by cheaper pozzolanic material hence economical.
b. It generates reduced heat of hydration and that too at a low rate.
c. As the fly ash is finer and of lower density, the bulk volume of 50 kg bag is slightly more than OPC.

Local Sand
Those fractions from 4.75 mm to 150 micron are termed as fine aggregate. The river sand and crushed sand is be used in combination as fine aggregate conforming to the requirements of IS:383. Aggregates are the important constituents in concrete. They give body to the concrete, reduce shrinkage and effect economy. One of the most important factors for producing workable concrete is a good gradation of aggregates. Good grading implies that a sample fraction of aggregates in required proportion such that the sample contains minimum voids. Minimum paste means less quantity of cement and less water, which are further mean increased economy, higher strength, lower shrinkage and greater durability.

Coarse aggregate
The fractions from 20 mm to 4.75 mm are used as coarse aggregate. The Coarse Aggregates from Crushed Basalt rock, conforming to IS: 383 is being used. These properties show very little presence of Chloride (Cl-) which is associated with corrosion of steel imbedded in concrete. Also, the properties show minimal presence of Sulphates (SO3) which causes formation of secondary ettringite (calcium sulfo- aluminate) in concrete leading to its expansion and rupture; thus the coarse aggregates are deemed to be innocuous and are suitable for production of concrete.

Wooden dust
saw dust concrete consist of roughly equal parts by volume of Portland cement, sand and pine saw dust, with water to give a slump of 25 to 50 mm. it bonds well to ordinary concrete and is a good insulator. Saw dust from tropical hardwood has used to make sawdust concrete with a 28 days compressive strength of 30 Mpa and a spitting strength of 2.5 Mpa the concrete has density of 1490kg/m3. The wooden dust is replaced in varying proportion in place of sand (0%, 5%, 10%, 15%, 20%, 30%)

Limestone
The addition of limestone reduces the initial and final setting time, as well as porosity. Processed Limestone is usually used in the finishing works of building envelopes as decorative materials. The limestone waste is produced in large areas as a waste material and crushed into desired sizes as the aggregate. The varying proportion of the limestone aggregate is used in placed of coarse aggregate with different percentage (0%, 10%, 20%, 50%, 75%, 100%)

Method

Mixing
The required quantities of material were weighted out as per proportions and mixing was done as per IS specification. Drum type mixer was used for mixing the material.

Moulding
Size of the mould of 150mm * 150 mm *150mm is used. Various mix proportion provided are cement + coarse aggregate (Fine sand + wooden dust) were tested

Vibrating
For vibrating the filled moulds the machine vibrator is used for proper compacting of the mould.

Curing
The specimen is divided in to 2 sets after the vibration and the testing for the blocks and cylinders for 7 days and 28 days. De-moulding of the specimen was done after the 24 hours.

Testing
Blocks were tested for the compressive strength of the block and cylinder at 7 days and 28 days.
Curing and its types plays vital role on the effect of compressive strength. The main objective of curing is to keep curing saturated or nearly saturated so as to support the hydration of cement, eliminates problem like plastic shrinkage.

The various tests to be performed in this project are the workability, strength and durability test

Material and its Properties

Wooden Dust

The wooden husk or the saw dust is a light weight material compare to the fine aggregate which makes the structure more light in weight, less costly and environment friendly.

S.N.	*Properties*	*Value*
1.	Moisture	4.75%
2.	Water absorption	5.24%
3.	Specific gravity (G)	0.39
4.	Fineness by wet sieving retaining on 45 microns	15.95%

Physical properties of the wooden husk

Limestone

Physical properties of limestone

S.N.	*Properties*	*Value*
1.	Water absorption	0.6%
2.	Specific gravity (G)	2.67
3.	Fineness by wet sieving retaining on 12.5 microns	0.59%

Experimental Program

From the previous research papers we conclude that by replacing the limestone upto 20 % we get the maximum compressive strength and with the adding of the admixtures getting strength up to 50% and by replacing the wooden Dust by the Fine aggregates (sand) the strength and the weight of the structure decreases and reduce the overall cost and to minimize the environmental issues created due to the sand. For the varying proportion of wooden dust (5%, 10%, 15%, 20%, 30%) without replacing of the limestone and try to find the optimum proportion. In the second mixes by taking the optimum proportion of wooden dust and the varying proportion of limestone (0%, 10%, 20%, 50%, 75%, 100%) which makes the structure the environmental friendly and low in weight. The specimen was tested for the 7 and 28 days.
The required quantities of material were weight in different proportion and mixing were done. Drum type of mixer was used for mixing the material. Casting were done and compacted with the help vibrating machine.

The mix design for the project is

	Mix proportions (kg/m3)			
w/c ratio	water	cement	sand	Gravel
0.5	195	390	709.7483	1276.069

5. Conclusion

1. From the previous research papers it can be found that the limestone can be used in place of and coarse aggregate in concrete. Flexural strength increased about 8% when using 50% limestone waste and 15% as admixture enhancement the compressive strength.
2. The replacement of the limestone in place of coarse aggregate is possible without admixture the it can mixed upto 50% but after that the strength reduces and with admixture it can be beyond the 50%.
3. 100% crushed limestone aggregate have the compressive strength of 38.7 Mpa.
4. The compressive strength, split tensile strength and flexural strength were reduced as the wooden dust is increased more than 25%.
5. The replacement of 10% Saw Dust with sand, there is about 10% reduction in weight and 3% reduction in production cost.
6. Water absorption capacity increases with increase % of sawdust. Larger absorption of water causes the reduction in the strength.
7. We are trying to find the optimum proportion of the limestone and the wooden husk by which the maximum strength is achieved and the concrete will have light in weight compared to the normal concrete and environment friendly also.

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