PARTIAL REPLACEMENT OF CEMENT BY QUARRY DUST

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Abstract

Q*uarry dust a waste product obtained from stone crushing. The aim of experimental investigation is to replace cement with quarry dust. In this test the replacement of cement in concrete with quarry dust are 0%,10%,20%,25%,30%,40% and M_{30} grade concrete cubes of size 150mm×150mm×150mm were cast for finding its compressive strength. From the experimental studies it is observed that by 25% of partial replacement of cement with quarry dust improved hardened concrete properties.*

Keywords: *Quarry dust, cement, water, aggregates.*

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1. INTRODUCTION

Quarry dust is a waste product obtained from **quarrying**. It can be used as an effective filler material instead of cement. In the present study, the properties of concrete using **quarry dust** were investigated.

Table 1: Physical Properties of Quarry dust

S.No	Particulars	Properties
1	Colour	Gray
2	Shape texture	Irregular
3	Mineralogy	Non crystalline
4	Particle size	>45micron
5	Odour	Odourless
6	Specific gravity	2.3

Table 2: Chemical Properties Of Quarry Dust

S.NO	Particulars	Proportion
1	Silicon dioxide	86.94%
2	Aluminium oxide	0.2%
3	Iron oxide	0.1%
4	Calcium oxide	0.3-2.2%
5	Magnesium oxide	0.2-0.6%
6	Sodium oxide	0.1-0.8%
7	Potassium oxide	2.1-2.30%

Selection of W/C Ratio

Max W/C RATIO = 0.45 [from IS 456:2000]
Adopt = 0.42

Fine Aggregate

In this concrete mixture sand is the fine aggregate. **Sand** is a naturally occurring granular material composed of finely divided rock and mineral particles. In terms of particle size as used by geologists, sand particles range in diameter from 0.0625 mm (or $\frac{1}{16}$ mm) to 2 mm.

Course Aggregate

Uncrushed gravel or stone which is the result of natural disintegration and crushed gravel or stone are usually called the "Coarse Aggregates".As mentioned earlier, coarse aggregates are stones that are retained on 4.75mm sieve.

Water

As per IS 456:2000, water used for both mixing and curing should be free from injurious amount of deleterious materials. Portable water (tap water) is generally considered satisfactory for mixing and curing concrete.

Cement

In this experiment we use, which cement has good fineness and good normal consistency. In this experiment we use OPC 43grade cement.

Mix Proportions

SI No	Mix Designation	%QD	W/C	Cement Kg (1 Cubic meter)	Fine Aggregate Kg (1Cubic meter)	Quarry dust Kg (1Cubic meter)	Coarse Aggregate Kg (1Cubic meter)	Water in lit
1	M30	0%	0.42	353	980	0	1120	148
2	M30	10%	0.42	317.7	980	35.3	1120	191.58
3	M30	20%	0.42	282.4	980		1120	191.58
4	M30	25%	0.42	264.75	980	88.25	1120	191.58
5	M30	30%	0.42	247.1	980	105.9	1120	191.58
6	M30	40%	0.42	225.5	980	122.5	1120	191.58

2. MIX DESIGN

In this mix design we prepare M_{30}grade Concrete using cement, sand, course aggregate, water & some percentage of quarry dust which replaces the cement. In this experimental investigation concrete cubes of 150mm×150mm×150mm were casted and cured for 7,14 & 28 days conventionally.
In this experimental investigation cubes casted with partial replacement of cement by quarry dust with percentages 0%, 10%, 20%, 25%, 30%, and end up with 40%. M30 grade of concrete is designed according to IS: 10262:2009 code provisions. Compressive strength of the cubes were casted and cured for 7, 14 & 28 days. From the test data the results were presented in table 3 and also plot is shown in chart1.

Fig 1: Compresive Strength

3. RESULTS

Table 3: Compressive Strength

S.NO	Grades	C.S for 7 days	C.S for 14 days	C.S for 28 days
1	M30(0%)	35	37	36
2	M30(10%)	36.5	36.9	36
3	M30(20%)	37.5	36.9	38.5
4	M30(25%)	41.5	40.5	41.5
5	M30(30%)	36	37.5	35
6	M30(40%)	27.9	27	27.5

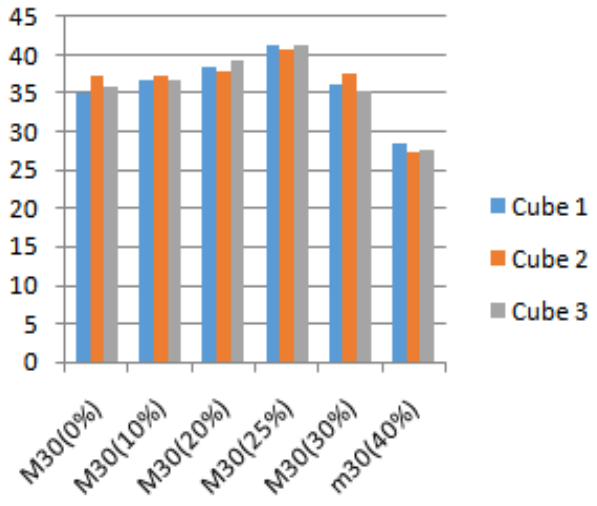

Chart 1: Compressive Strength of cubes

Abbreviations:
Cube1 = 7 days curing
Cube 2 = 14 days curing
Cube 3= 28 days curing
CS =Compressive strength
QD = Quarry dust

4. CONCLUSION

The analysis of experimental investigation data shown that addition of 25% quarry dust with cement gives the compressive strength of 41.5 N/mm^2 when compared to conventional i.e. without any replacement of quarry dust. From the above test results, It is clearly observed that addition of quarry dust up to certain extent will increase the compressive strength of concrete.

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