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Special Concrete by Using Quarry Dust as Partial Replacement of Cement

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Article Info
Volume 83
Page Number: 2020 - 2026
Publication Issue:
March - April 2020

Article History
Article Received: 24 July 2019
Revised: 12 September 2019
Accepted: 15 February 2020
Publication: 18 March 2020

Abstract
The objective of the present project work is to study the behavior of concrete in partial replacement for cement with quarry dust in proportions. Quarry dust a waste from the quarry processing units accounts 30% of the final product from quarry industry. In order to achieve the stated objectives, this study is carried out in different stages. In the initial stage, all the materials and equipment needed must be gathered or checked for availability. Oncethe characteristics of the materials selected have been studied through appropriate tests, the applicable standards of specification are referred. The properties of hardened concrete are importantasit is retained fortheremainder of the concrete life. Ingeneral, the important properties of hardened concrete are strength and durability. An experimental program is held to measure strength of hardenedconcrete.

Keywords: *Classification, Machine Learning, Apache Spark , Hadoop.*

I. Introduction

Inthepastonlystrengthofconcretewasconsideredintheconcretemixdesign procedure assuming strengthof concrete in all pervading factor for all other desirable properties of concrete including durability. In the recent revision of IS 456 of 2000, oneofthepointsdiscussed,deliberatedandrevisedisthedurabilityaspectsofconcrete, in line with codes of practice of other countries, which have better experiences in dealingwithdurabilityofconcretestructures.Oneofthemainreasonsfordeterioration of concrete in the past is that too much emphasis is placed on concrete compressive strength. As a matter of fact, advancement in concrete technology has been generally on the strength of concrete. It is now recognized that strength of concrete alone is not sufficient, the degree of harshness of the environment condition to which concrete is exposed over its entire life is equallyimportant.

II. Literature Review

Ganesha Mogaveera. G.Sarangapani and Anand V.R. (2011) have studied the effect of Partial Replacement of Sand by Quarry dust in Plain Cement Concretefordifferentmixproportions.Theyhaveconcludedthatsandcanbereplaced effectively by means of quarry dust up to 20% to25%.

III. Testes on Materials

COMPRESSIVE STRENGTHS FOR DIFFERENT GRADES OF CONCRETE WITH DIFFERENT CURINGPERIODS

M20 7 days average compressivestrength:

Mix. No	W/C	% of Cement	% of Quarry Dust	7 Days Avg Compressive Strength (Mpa)
1	0.44	100	0	18.48
2	0.44	90	10	18.30
3	0.44	80	20	20.75
4	0.44	70	30	17.43

Table-1 Compressive strength for M20 Concrete-7 days curing

M20 28 days average compressivestrength:

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Mix. No	W/C	% of Cement	% of Quarry Dust	28 Days Avg Compressive Strength (Mpa)
1	0.44	100	0	23.69
2	0.44	90	10	23.38
3	0.44	80	20	23.90
4	0.44	70	30	20.62

Table-2 Compressive strength for M20 Concrete-28 days curing

M30 7 days average compressivestrength:

Mix. No	W/C	% of Cement	% of Quarry Dust	7 Days Avg Compressive Strength (Mpa)
1	0.42	100	0	29.87
2	0.42	90	10	28.29
3	0.42	80	20	27.62
4	0.42	70	30	24.00

Table-3 Compressive strength for M30 Concrete-7 days curing

M30 28 days average compressivestrength:

Mix. No	W/C	% of Cement	% of Quarry Dust	7 Days Avg Compressive Strength (Mpa)
1	0.40	100	0	35.50
2	0.40	90	10	35.75
3	0.40	80	20	33.54
4	0.40	70	30	29.27

Table-4 Compressive strength for M30 Concrete-28 days curing

M40 7 days average compressivestrength:

Mix. No	W/C	% of Cement	% of Quarry Dust	28 Days Avg Compressive Strength (Mpa)
1	0.42	100	0	41.70
2	0.42	90	10	40.54
3	0.42	80	20	42.50
4	0.42	70	30	39.78

Table-5 Compressive strength for M40 Concrete-7 days curing

M40 28 days average compressivestrength:

Mix. No	W/C	% of Cement	% of Quarry Dust	28 Days Avg Compressive Strength (Mpa)
1	0.40	100	0	53.80
2	0.40	90	10	53.50
3	0.40	80	20	52.45
4	0.40	70	30	49.60

Table-6 Compressive strength for M40 Concrete-28 days curing

IV. MIX DESIGN

Design of M20 as per **IS:10262:2009.**

a) Maximum sizeofaggregate = 20 mm
b) Degreeof workability = 0.90
c) Degreeofworkability = Good
d) Typeof exposure = Mild

W	C	FA	CA
186	422.73	622.91	1181.49
0.44	1	1.47	2.79

Design of M30 as per IS:10262:2009.

a) Maximum size of aggregate = 20 mm
b) Degree of workability = 0.90
c) Degree of workability = Good
d) Type of exposure = Mild

W	C	FA	CA
176	420	626.29	1208.56
0.42	1	1.49	2.87

Design of M40 as per IS:10262:2009.

a) Maximum sizeofaggregate = 20mm
b) Degreeofworkability =0.90
c) Degreeof workability =Good
d) Typeof exposure =Mild

W	C	FA	CA
180	450	606.86	1191.52
0.42	1	1.35	2.65

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V. Result

M20 average % of mass loss after immersion in H_2SO_4:

Mix.No	% of Cement	% of Quarry dust	7 Days Avg % of weight loss	28 Days Avg % of weight loss
1	100	0	5.56	10.48
2	90	10	10.80	10.80
3	80	20	12.72	11.05
4	70	30	15.12	11.40

Table-7M20 average % of mass loss after immersion in H_2SO_4

M30 average % of mass loss after immersion inH_2SO_4:

Mix.No	% of cement	% of Quarry dust	7 Days Avg % of weight loss	28 Days Avg % of weightloss
1	100	0	4.76	9.65
2	90	10	7.92	11.72
3	80	20	7.18	11.83
4	70	30	18.81	11.75

Table-8 M30 average % of mass loss after immersion in H_2SO_4

M40 average % of mass loss after immersion inH_2SO_4:

Mix.No	% of Cement	% of Quarry dust	7 Days Avg % of weight loss	28 Days Avg % of weight loss
1	100	0	2.60	3.38
2	90	10	1.06	3.20
3	80	20	1.35	5.25
4	70	30	2.45	3.90

Table-9 M40 average % of mass loss after immersion in H_2SO_4

M20 average % of mass loss after immersion inHCL:

Mix. No	% of Cement	% of Quarry dust	7 Days Avg % of weight loss	28 Days Avg % of weight loss
1	100	0	6.60	9.98
2	90	10	6.88	11.25
3	80	20	6.86	11.48
4	70	30	6.87	11.70

Table-10 M20average % of mass loss after immersion in HCL

M30 average % of mass loss after immersion inHCL:

Mix. No	% of Cement	% of Quarry dust	7 Days Avg % of weight loss	28 Days Avg % of weight loss
1	100	0	2.10	1.13
2	90	10	2.34	2.35
3	80	20	1.55	1.82
4	70	30	1.88	2.63

Table-11 M30 average % of mass loss after immersion in HCL

M40 average % of mass loss after immersion inHCL:

Mix.No	% of Cement	% of Quarry dust	7 Days Avg % of weight loss	28 Days Avg % of weight loss
1	100	0	3.00	0.21
2	90	10	2.50	3.50
3	80	20	1.70	2.48
4	70	30	2.72	3.50

Table-12 M40 average % of mass loss after immersion in HCL

M20 average % of 7 days Strength deterioration when immersed in H_2SO_4:

Mix. No	% of Cement	% of Quarry Dust	7days Avg. Compressive Strength before immersion	7days Avg. Compressive Strength after immersion (H_2SO_4)	Average % of Strength deterioration
1	100	0	18.48	14.96	19.05
2	90	10	18.30	12.92	29.40
3	80	20	20.75	14.58	29.73
4	70	30	17.43	12.57	27.88

Table-13 M20 average % of 7 days Strength deterioration when immersed in H_2SO_4

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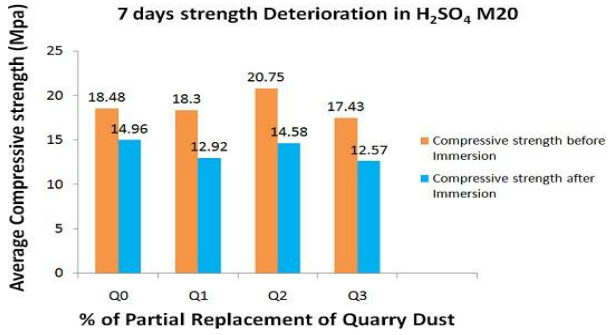

Fig-(7) 7 days strength deterioration in H2SO4-M20

M20 average % of 28 days Strength deterioration whenimmersed inH2SO4

Mix.No	% of Cement	% of Quarry Dust	28 days Avg. Compressive Strength before immersion	28 days Avg. Compressive Strength after immersion (H2SO4)	Average % of Strength deterioration
1	100	0	23.69	13.02	45.04
2	90	10	23.38	11.98	48.76
3	80	20	23.90	12.90	46.02
4	70	30	20.62	11.45	44.48

Table-14 M20 average % of 28 days Strength deterioration when immersed in H2SO4

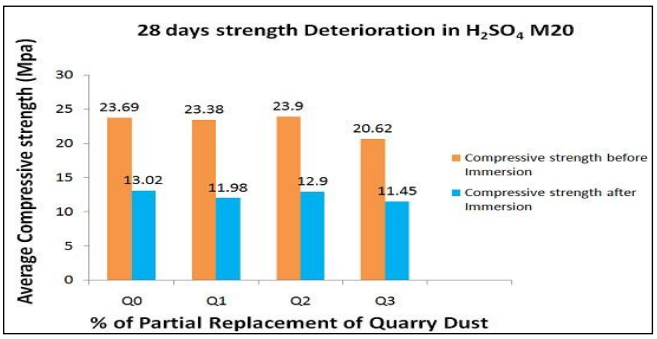

Fig-(8) 28 days strength deterioration in H2SO4 - M20

M30 average % of 7 days strength deterioration when immersed inH2SO4

Mix. No	% of Cement	% of Quarry Dust	7days Avg. Compressive Strength before immersion	7days Avg. Compressive Strength after immersion(H2SO4)	Average % of Strength deterioration
1	100	0	29.87	20.15	32.54
2	90	10	28.29	14.80	47.68
3	80	20	27.62	16.95	38.63
4	70	30	24.00	14.70	38.75

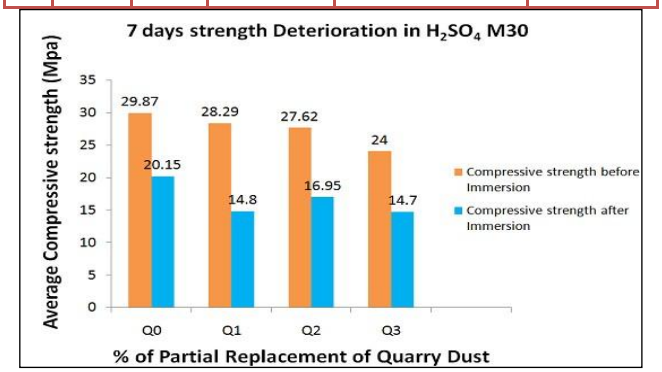

Table-15 M30 average % of 7 days strength deterioration when immersed in H2SO4

Fig-(9) 7days strength deterioration in H2SO4 – M30

M30 average % of 28 days strength deterioration when immersed inH2SO4

Mix. No	% of Cement	% of Quarry Dust	28 days Avg. Compressive Strength before immersion	28 days Avg. Compressive Strength after immersion (H2SO4)	Average % of Strength deterioration
1	100	0	41.70	14.55	65.10
2	90	10	40.54	13.90	65.70
3	80	20	42.50	14.40	66.10
4	70	30	39.78	13.60	65.81

Table-16 M30 average % of 28 days strength deterioration when immersed in H2SO4

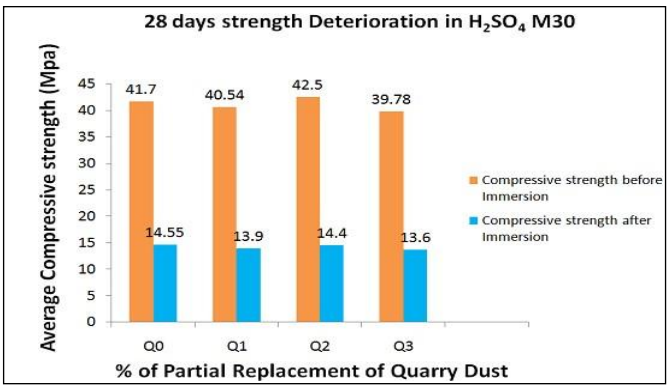

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Fig-(10) 28days strength deterioration in H2SO4 – M30

M40 average % of 7 days strength deterioration when immersed inH2SO4

Mix. No	% of Cement	% of Quarry Dust	7days Avg. Compressive Strength before immersion	7days Avg. Compressive Strength after immersion (H2SO4)	Average % of Strength deterioration
1	100	0	35.50	26.80	24.50
2	90	10	35.75	17.20	51.88
3	80	20	33.54	18.00	46.33
4	70	30	29.27	16.30	44.30

Table-17 M40 average % of 7 days strength deterioration when immersed in H2SO4

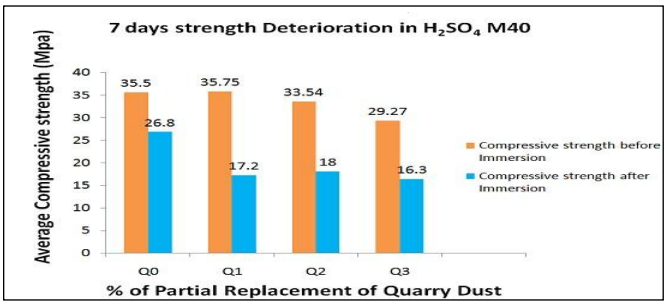

Fig-(11) 7days strength deterioration in H2SO4 – M40

M40 average % of 28 days strength deterioration when immersed inH2SO4:

Mix. No	% of Cement	% of Quarry Dust	28 days Avg. Compressive Strength before immersion	28 days Avg. Compressive Strength after immersion (H2SO4)	Average % of Strength deterioration
1	100	0	53.80	15.50	71.19
2	90	10	53.50	12.45	76.73
3	80	20	52.45	14.30	72.74
4	70	30	49.60	12.30	75.20

Table-18 M40 average % of 28 days strength deterioration when immersed in H2SO4

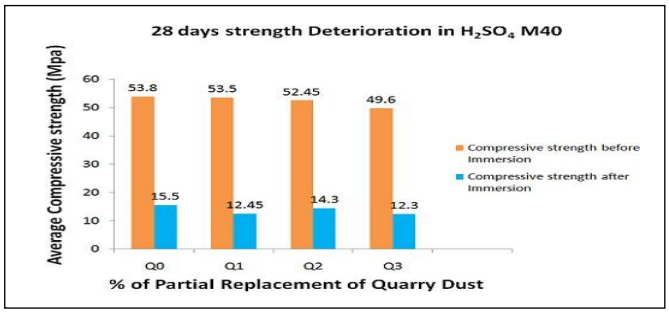

Fig-(12) 28days strength deterioration in H2SO4 – M40

M20 average % of 7 days strength deterioration when immersed in HCL

Mix. No	% of Cement	% of Quarry Dust	7days Avg. Compressive Strength before immersion	7days Avg. Compressive Strength after immersion (H2SO4)	Average % of Strength deterioration
1	100	0	18.48	26.95	- 45.83
2	90	10	18.30	26.10	- 42.62
3	80	20	20.75	22.18	- 6.89
4	70	30	17.43	20.20	- 15.89

Table-19 M20 average % of 7 days strength deterioration when immersed in HCL

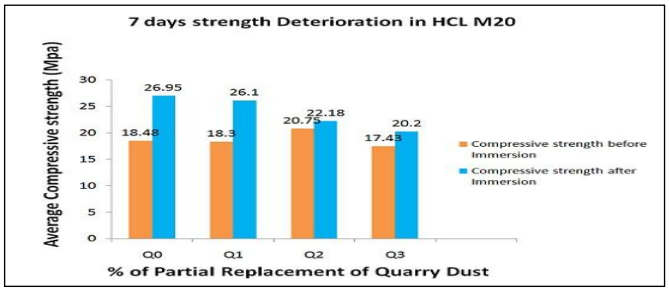

Fig-(13) 7days strength deterioration in HCL– M20

M20 average % of 28 days strength deterioration when immersed inHCL

Mix. No	% of Cement	% of Quarry Dust	28 days Avg. Compressive Strength before immersion	28 days Avg. Compressive Strength after immersion (H2SO4)	Average % of Strength deterioration
1	100	0	23.69	28.38	- 19.80

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2	90	10	23.38	30.39	- 29.98
3	80	20	23.90	30.00	- 25.52
4	70	30	20.62	23.25	- 12.75

Table-20 M20 average % of 28 days strength deterioration when immersed in HCL

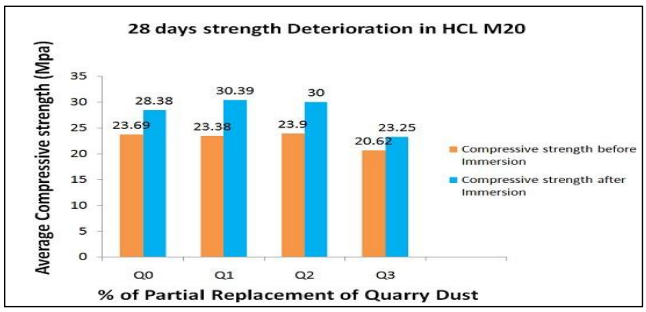

Fig-(14) 28days strength deterioration in HCL–M20

M30 average % of 7 days strength deterioration when immersed in HCL

Mix .N o	% of Cement	% of Quarry Dust	7days Avg. Compressive Strength before immersion	7days Avg. Compressive Strength after immersion(H2SO4)	Average % of Strength deterioration
1	100	0	29.87	33.90	- 13.49
2	90	10	28.29	24.55	13.22
3	80	20	27.62	31.00	- 12.24
4	70	30	24.00	22.50	6.25

Table-21 M30 average % of 7 days strength deterioration when immersed in HCL

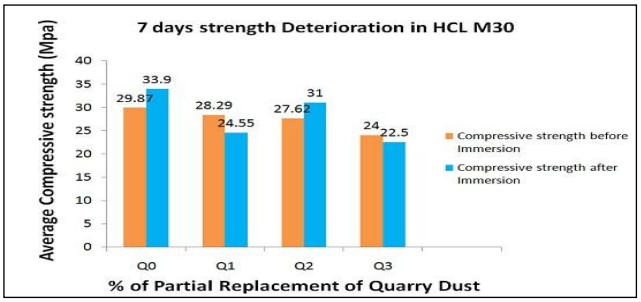

Fig-(15) 7days strength deterioration in HCL–M30

M30 average % of 28 days strength deterioration when immersed inHCL

Mix. No	% of Cement	% of Quarry Dust	28 days Avg. Compressive Strength before immersion	28 days Avg. Compressive Strength after immersion (H2SO4)	Average % of Strength deterioration
1	100	0	41.70	30.88	25.95
2	90	10	40.54	31.25	22.92
3	80	20	42.56	30.48	28.38
4	70	30	39.78	25.35	36.27

Table-22M30 average % of 28 days strength deterioration when immersed in HCL

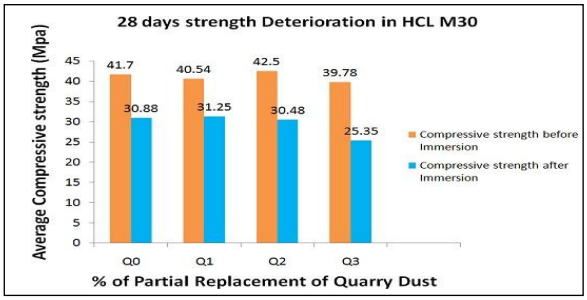

Fig-(16) 28days strength deterioration in HCL–M30

M40 average % of 7 days strength deterioration when immersed in HCL

Mix. No	% of Cement	% of Quarry Dust	7days Avg. Compressive Strength before immersion	7days Avg. Compressive Strength after immersion (H2SO4)	Average % of Strength deterioration
1	100	0	35.50	39.45	- 11.10
2	90	10	35.75	36.35	- 1.68
3	80	20	33.54	30.10	10.26
4	70	30	29.27	29.80	- 1.80

Table-23M40 average % of 7 days strength deterioration when immersed in**HCL**

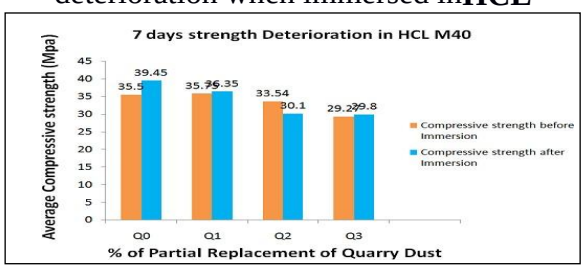

Fig-(17) 7days strength deterioration in HCL–M40

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M40 average % of 28 days strength deterioration when immersed inHCL

Mix. No	% of Cement	% of Quarry Dust	28 days Avg. Compressive Strength before immersion	28 days Avg. Compressive Strength after immersion (H2SO4)	Average % of Strength deterioration
1	100	0	53.80	34.85	35.22
2	90	10	53.50	31.88	40.41
3	80	20	52.45	28.85	44.99
4	70	30	49.60	26.05	47.48

Table-24 M40 average % of 28 days strength deterioration when immersed in HCL

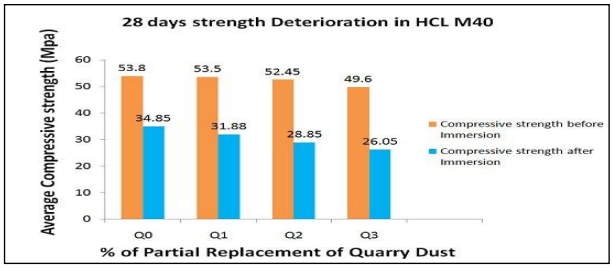

Fig-(18) 28days strength deterioration in HCL– M40

VI. Conclusion

From 10% to 20% replacement of quarry dust with cement the strength properties areincreasedlinearlyandfrom20%to30%ofreplacementofquarrydust,decreasein strength of concrete wasobserved.NochangeofW/Cratiowasobservedby replacementofcementwithquarry dust, as quarry dust is a waste material; W/C ratio was compared with cement concrete.From the experiments conducted, replacement of quarry dust can be made for cement, as cement content in concrete can beoptimized.

VII. References

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