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Experimental Investigation of Concrete by Using Limestone Fines as Replacement to Cement

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ABSTRACT: Admixtures in concrete are now either mineral or chemical admixtures. The current research looks on using limestone powdered dust as an additive material in concrete. The current research examines the use of limestone powdered dust as a partial substitute for cement in concrete preparation. In the construction industry, concrete is widely used material in construction industry. Fresh and hardened concrete qualities, as well as their endurance when admixed with Lime powdered dust, are studied in this study. Cement, sand, coarse particles, and water are the main ingredients in concrete. In this investigation, lime powdered dust is used as a cement substitute. The usage of this trash saves a lot of energy and reduces the amount of cement used. With the utilisation of this waste as a supplementary and replacement material, there is significant energy conservation and reduction in cement use, which helps to minimise CO₂ emissions in the environment. IS-10262:2019 specifies the design of concrete mixes. Replacement cement with lime powdered dust at various percentages of 5-20% was utilised to explore the behaviour of replaced Limestone powdered dust concrete in comparison to typical conventional concrete.

KEYWORDS: Concrete, Limestone powdered dust, Cement.

I. INTRODUCTION

This Concrete is a mixture consisting of coarse aggregate linked together with fluid cement and hardening over time. Lime-based concretes are extensively used, such as Portland cement concrete or concrete made with other hydraulic cement. Concrete is made from cement, air, water, sand, and gravel. Limestone is a sedimentary rock composed primarily of calcium carbonate (CaCO₃) in the form of calcite and aragonite. The soil may contain substantial levels of magnesium carbonate (dolomite) as well as minor elements such as clay, iron carbonate, feldspar, pyrite, and quartz. Most limestones have a granular texture. The grains that make up the constituent particles of this material can be quite small, ranging from 0.001 mm to visible size particles. The grains are often small fragments.



Limestone Powder

Concrete is a mixture of Portland cement (10-15%), water (15-20%), and aggregates (65-75%). The cement and water mix to form a hard, rock-like structure. An additive that can be mixed into concrete to change its properties is known as an admixture. Added to this are additives. Concrete additives are divided into two types, each of which is used to improve the behaviour of concrete in a number of situations. Chemical additives reduce the cost of construction, change the properties of hardened concrete, ensure the quality of concrete during mixing, transportation, placement and curing. Chemical additives are added to concrete during the mixing, transport, laying and curing stages to improve its quality. There are different groups of appliances in a air conditioning system: air conditioners, set retarders, set accelerators, and set water reducers. Mineral admixtures with special abilities to plasticize plastic are available.



IS: 456:2000 allows the following mineral admixtures to be used:

- (1) Metakaolin (IS 15388),
- (2) Rice husk ash (IS 15388),
- (3) Fly ash (IS 3812),
- (4) Silica fume (IS 15388),

II. LITERATURE REVIEW

A. *K Rajesh, B Ganesh, Ch Bhaskara rao (2017);*

"An experiment was conducted on the strength of lime stone powder concrete with partially substitution of cement and fine aggregate". In this study, lime powder is employed as a waste material in the construction sector. The goal of the experiment is to find out how strong a concrete mix is in compressive, flexural, and split tensile strength tests. 0- 100% with the increment of 10% lime replacement of cement Lime powder (by weight) At 7th and 28th days, the maximum compressive strength was achieved at 10% and 60%, respectively. Split and flexural strength improves by 10%, and the 80 percent replacement period is 28 days. To enhance the workability of concrete, increase the quantity of lime in the mix.

B. *P.Meenaksh (2017);*

Lime powder is used to partially replace cement in concrete in this study. M30 is the concrete mix grade. In the experiments, the cement was used as a partial replacement for barites and limestone powder at percentages of 0%, 10%, 20%, and 30%. Early on (7 days), the replacement ingredients increased compressive strength, and 14 days later,

the same outcome was achieved. The compressive strength of the concrete substitute remains unchanged after 28 days.. workability.

C. *Abdul Hakeem Hamed Ahmed (2009);*

The effects of temperature on the strengths of materials were discussed, as well as the practicality of using limestone powder as a partial replacement for cement in concrete mixtures. Some conclusions can be drawn from this study. Using limestone powder as cement has the benefit of improved flow properties and increased compressive strength. As the percentage of cement being replaced by limestone powder increases, the decline in concrete increases. According to the study, as the amount of limestone powder used to compensate for the lack of lime in concrete increases, the compressive strength of the concrete improves. Concrete prepared with 15% limestone powder is the strongest.

D. *W. Gudissa and A. Dinku;*

An experiment was carried out to see if limestone powder could be used as a cement replacement material. Limestone powder is used to explore the physical and chemical properties of cement paste and hardened concrete. High early strength cement has a typical compressive strength of 42.5 MPa, with OPC substitution of limestone powder ranging from 5% to 10%. Cement clinkers were replaced with limestone filters, which increased the compressive strength of the early strength of 32.5Mpa by 15% to 20%. At 28 days of normal compressive strength, limestone powder is somewhat heavier than clinker, ranging from 25% to 32%.

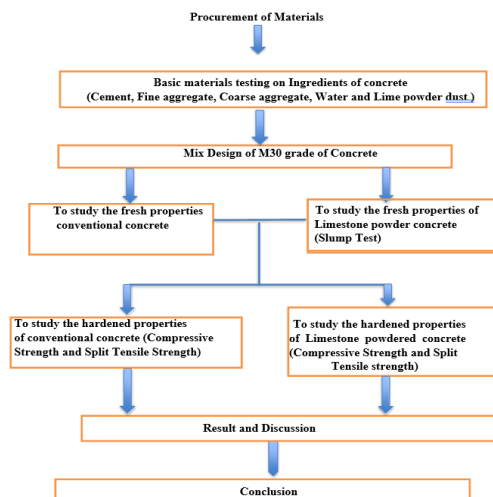
E. *Taron R. Naik (2003);*

In general, employing limestone powder filler in cement and concrete accelerates hydration, dilutes cement paste, increases the effective w/c ratio, and promotes strength early on. When limestone powder filler is added to fine cement pastes and mortars, the chloride ion diffusion coefficient is lowered. Limestone powder in cement and concrete reduces Portland cement output and CO₂ emissions while also increasing early and later age compressive strength.

III. OBJECTIVES

- 1) As per IS codal provisions, conduct basic tests on cement, fine aggregate, coarse aggregate, water, and limestone.
- 2) To compare the fresh qualities of standard concrete and limestone powdered concrete using different percentages of 5, 10, 15, and 20%.
- 3) To compare the hardened properties of ordinary concrete with limestone powder concrete with different percentages of 5, 10, 15, and 20%.
- 4) Determine whether limestone powder dust is suitable for long-term building.

IV. METHODOLOGY



F. Tests On Fresh Concrete: Slump Cone Test:

A concrete slump test is used to determine the stability of a concrete mix while it is being constructed. Concrete slump testing is used to make sure the quality of concrete from batch to batch is consistent.



Experimental Conducted on Slump Test



Cube Before Casting

G. Tests On Harden Concrete: Compressive Strength of Concrete:

The most important concrete test is the most accurate way to measure the material's characteristics. This one test can help determine if the concreting was done correctly. The water-cement ratio, cement strength, concrete material quality, and quality control throughout the manufacturing process all contribute to the compressive strength of concrete.

Concrete compressive strength at various ages as per (IS:456-2000 Clause 6.1,9.2.2,15.1.1 and 36.1)

Period	Percentage of Strength (%)
1 st Day	16
3 rd Days	40
7 th Days	65
14 th Days	90
28 th Days	99

Table-1 Concrete compressive strength at various ages as per

H. Split Tensile Test

Split Tensile strength is one of the most important properties of concrete. The technique for assessing the tensile strength of concrete is the split tensile strength test of concrete cylinders. Concrete is very weak in tension because it is brittle and not expected to resist direct tension. Cracks form when tensile forces are applied to concrete. To determine the maximum load that the concrete members can withstand before cracking, the concrete's tensile strength must be evaluated.



Cylinder Casting



Cylinder Testing Using UTM Machine

V. EXPERIMENTAL RESULTS

SLUMPVALUE FOR PERCENTAGE OF LIMESTONE REPLACEMENT

SL.NO	% Of limestone Replacement	W/C Ratio	Slump in mm
1.	0%	0.45	80
2.	5%	0.45	60
3.	10%	0.45	50
4.	15%	0.45	45
5.	20%	0.45	40

Table-2Slump value for percentage of Limestone replacement

SLUMPVALUE FOR CONVENTIONAL CONCRETE

SL.NO	W/C RATIO	SLUMP VALUE IN mm
1.	0	80

Table-3Slump value for Conventional Concrete

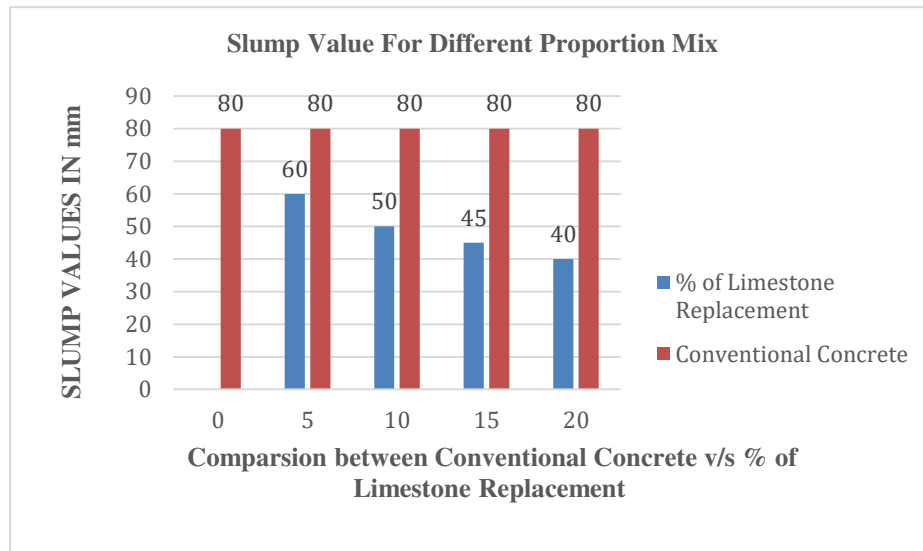


Figure-1 Slump Value For Different Proportion Mix

COMPRESSIVE STRENGTH (IS 516:2021)

Compressive Strength of Percentage of Limestone Replacement

SL.NO	% Of limestone powder	Average compression strength In Mpa	
		7 th Days	28 th Days
1.	0	19.50	33.39
2.	5	17.55	32.25
3.	10	18.05	33.95
4.	15	17.95	31.30
5.	20	17.40	30.50

Table-3 Compressive Strength of Percentage of Limestone Replacement

Compressive Strength of Conventional Concrete

SL.NO	Average Compression Strength In Mpa	
	7 th Days	28 th Days
1.	26.20	33

Table-4 Compressive Strength of Conventional Concrete

Compressive strength at 7 days

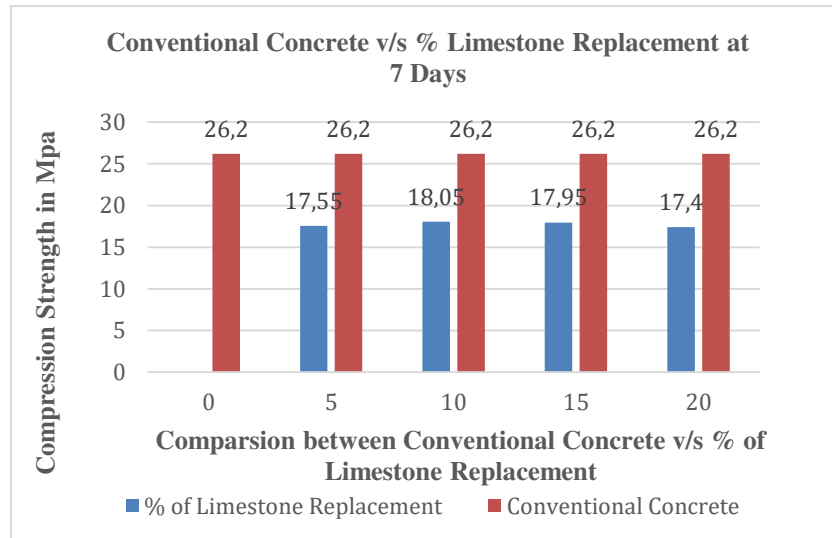


Figure-2 Compressive strength at 7 days

According to the graph, the compressive strength is highest when 10% of the cement is replaced with limestone powder, implying that the hydration process is at its peak at a young age. It is also lowered in order to achieve a better % replacement rate.

Compressive strength at 28 days

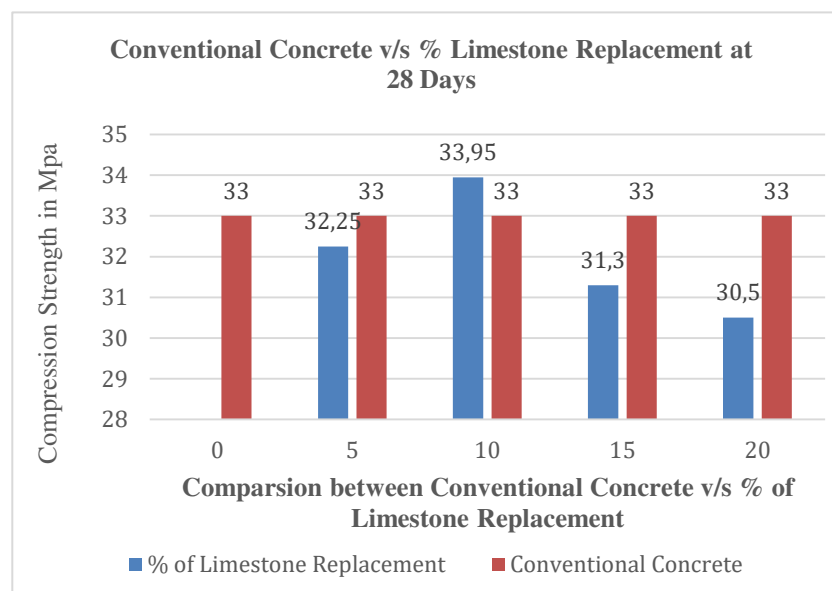


Figure-3 Compressive strength at 28 days

According to the graph, the compressive strength is highest when 10% of the cement is replaced with limestone powder, implying that the hydration process is at its peak at an early age. It is also lowered in order to achieve a better % replacement rate.

SPLIT TENSILE STRENGTH (IS 5816:2004)

Split Tensile Strength % of Limestone Powder Replacement

SLNo.	% Of limestone powder Replacement	Tensile Strength (Mpa)	
		7 th days	28 th days
1	0	1.95	3.339
2	5	1.755	3.225
3	10	1.805	3.395
4	15	1.795	3.13
5	20	1.74	3.05

Table-5 Split Tensile Strength % of Limestone Powder Replacement

Split-Tensile Strength of Conventional Concrete

SL.NO	Tensile Strength in Mpa	
	7 th Days	28 th Days
1.	1.56	2.83

Table-6 Split-Tensile Strength of Conventional Concrete

Tensile strength at 7 days

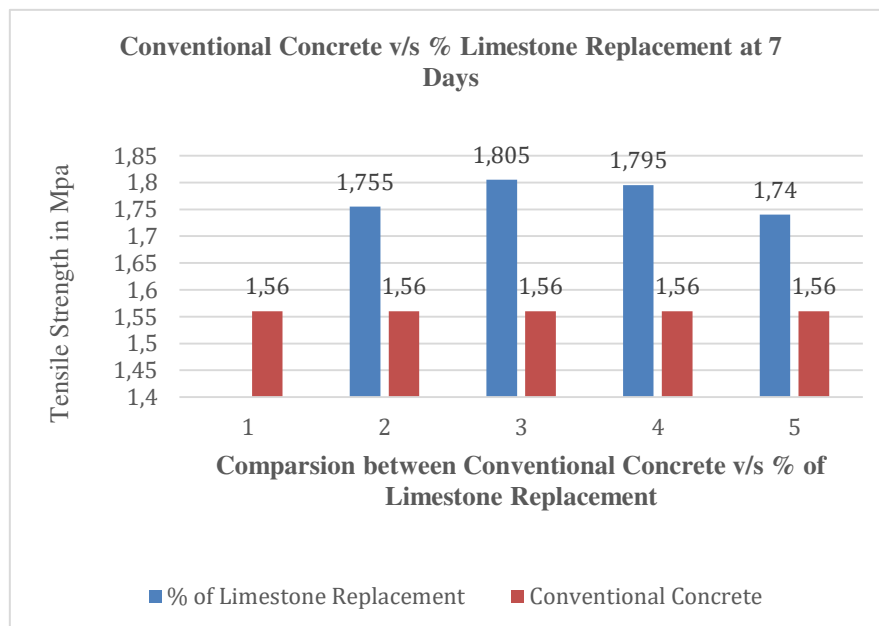


Figure-3 Tensile strength at 7 days

The data shows that the Split Tensile strength is highest when 10% of the cement is replaced with limestone powder, implying that the hydration process is at its peak at an early age. It is also lowered in order to achieve a better % replacement rate.

Tensile strength at 28 days

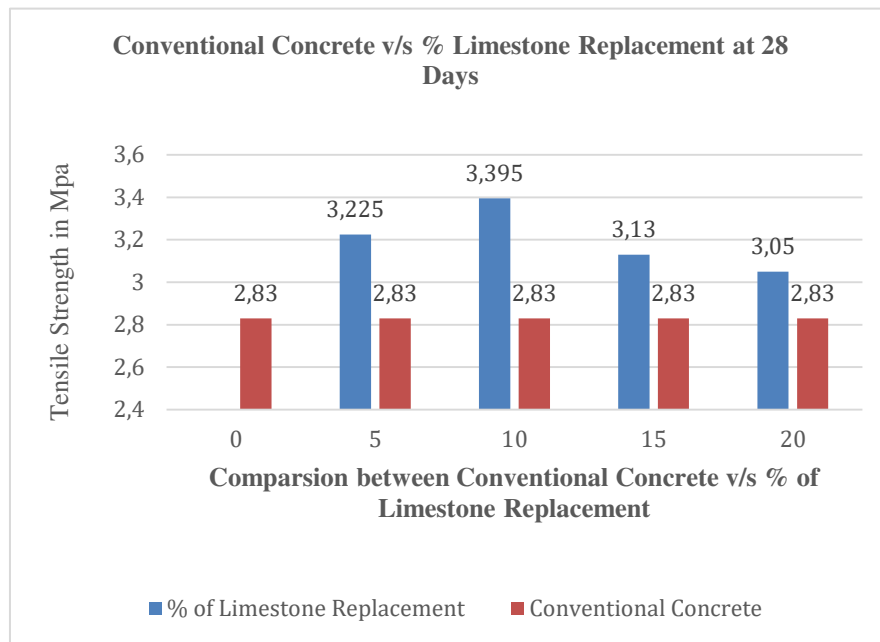


Figure-4 Tensile strength at 28 days

From the graph that the Split Tensile strength is highest when 10% of the cement is replaced with limestone powder, implying that the hydration process is at its peak at an early age. It's also reduced for a higher percent replacement rate.

V. CONCLUSION

The influence of the amount of limestone powder on the characteristics of concrete is investigated in this study. The gathered experimental data can be used to reach the following conclusions:

- Maximum Compression Strength is obtained for 10% of cement can be replaced by limestone powder without change in the strength of the concrete.
- Maximum split tensile strength can be reached by 10% replacement of cement by limestone powder.
- Adding limestone to Portland cement results in a finer cement, which leads to a higher rate of hydration and faster development of early strength. Reducing Portland cement production and CO₂ emissions through the use of limestone powder in cement and concrete can result in economic and environmental benefits.
- Basic tests on Cement, Limestone, Coarse Aggregates, Water, limits as per the IS Codal Provisional

REFERENCES

1. Anusha, P., & Ramya, K. S. (2018). Experimental Study on Concrete with Limestone Powder and Copper Slag. International Journal of Engineering Research and Management, 5(9), 6-12.
2. B Ganesh, Ch Bhaskara rao, K Rajesh (2017) studied on "experimental study on lime stone powder & copper slag strength of concrete with partial replacement of cement and fine aggregate", International journal of mechanical engineering and computer applications, Volume 5 (2017) 2320-6349.
3. Kumar, N., Kumar, G., M. Thirupathamma, D. Sasikala, & Sarada, R. (2017). Replacement of Cement by Lime Powder. International Journal & Magazine of Engineering, Technology, Management and Research, 4(4), 180-192.



- Gloria, A. C., Ogbonnaya, O. D., & Olujide, A. O. (2017).** Flexural and Split Tensile Strength Properties of Lime Cement Concrete. *Civil and Environmental Research*, 9(3), 10-16.
4. **W. Gudissa and A. Dinku (2010)** studied on the “use of limestone powder as an alternative cement replacement material an experimental study”, *Journal of EEA*. Vol. 27, 2010.
 5. **P. Meenaksh (2017)** studied on “partial replacement of cement by barites and lime powder in concrete”, *International Journal of Chemtech Research CODEN (USA): IJCRGG*, ISSN: 0974-4290, ISSN(Online):2455-9555 Vol.10 No.3, pp 143-148.
 6. **Abdul Hakeem Hamed Ahmed (2009)** Studies the effect of elevated temperature on the compressive, and tensile strengths.
 7. **P. Thongsanitgarn** Effect of lime stone powder on Compressive strength and setting time of Portland-Limestone cement past.
 8. **Lothenbach, B., Saout, G., Gallucci, E., Scrivener, K. (2008),**” Influence of limestone on the hydration of Portland cements”, *Cement and Concrete Research*, vol. 38, 2008, pp: 848–860.
 9. **Hawkins, P., Tennis, P., Detwiler, R. (2003),** “The use of limestone in Portland cement: a state ofthe-art review”, *Portland Cement Association*, 2003 Report n. EB227
 10. **M. Heikal, H. El-Didamony and M.S. Morsy,** Limestone-filled pozzolanic cement, *Cement and Concrete Research* 30 (2000) 1827-1834.



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