Effect on Concrete Incorporating Aglime Powder

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***Abstract*— The purpose of this work is to describe the effect of fine ground aglime powder on important physical and mechanical properties of concrete. lime powder has some similar characteristics of cement. The replacement percentages tried were 0%, 5%, 10%, 15% and 20% by weight of cement. The compressive, split tensile and flexural strengths of concrete with powdered agricultural lime were compared with those of the reference specimens. The results indicate that replacement of cement with aglime powder increases the compressive, split tensile and flexural strengths of concrete.**

***Index Terms*— Powdered Limestone; Portland Cement; Compressive Strength.**

I. INTRODUCTION

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. Concrete is the basic civil engineering material used in most of the civil engineering structures. Many materials are used to manufacture good quality concrete. Cement is the most important constituent material, since it binds the aggregates and resists the atmospheric action. Since the production of Portland cement clinker is an energy-intensive process, a partial substitution of clinker by mineral additions obviously represents considerable energy savings. It makes economic sense to reduce the energy used in the production of cement and concrete and at the same time make a safe use of what sometimes can be classified as an industrial waste. Agricultural lime powder is a manually made pulverized limestone and chalk which is noted for its remarkable wet ability and dispensability. Powdered limestone has a good weathering resistance. Aglime powder is a preferred for construction material due to its carbonate rich content . Some investigations confirmed that finely ground lime powder can be used as cementitious material to producecement. An attempt has been made to explore the possibility of using lime powder used in agro sector as a replacement material for cement.

II. MATERIALS AND METHODS

Cement is a binder, a substance that sets and hardens independently, and binds other materials together. Portland cement was used as the main binding material. To prepare a mix, gravel sand size up to 2.5mm was used as an aggregate, in the ratio 3:1 with Portland cement.

Dolomite is a rock forming mineral containing limestone which is noted for remarkable wet ability and dispensability as well as moderate oil and plasticizers absorption. limestone has good weathering resistance. Two kinds of aglime fine powder with mean particle size 4μm and 2.79μm and specific surface 5500 cm2/g and 7523 cm2/g, respectively, were examined. Mixtures containing finely aglime powder from 0 to 20% by weight of cement were prepared. Water/binder ratio of control specimens was0.5.

The most important function of the aggregate is to assist in producing workability and uniformity in mixture. River sand was used as fine aggregate. The specific gravity of sand was found to be 2.56.

The coarse aggregate is the largest component of concrete. Size of coarse aggregate used in the investigation was 10mm. The specific gravity of the coarse aggregate was found to be 2.68.

Water is an important ingredient of concrete as it actively participates in the chemical reaction with cement. Water for making concrete should have pH between 6 and 8. Locally available drinking water was used in this work.

TABLE I
PROPERTIES OF DOLOMITE

S.No	Property	Aglime Powder
1	Sp. Gravity	2.65
2	Colour	White
3	Moisture	Nil
4	Crystal System	Trigonal
5	Sieve analysis	Zone III

III. TEST RESULTS

A. Compressive Strength

The cube compressive strength of concrete was determined by conducting test on 150mm x 150mm x 150mm cube specimens at 7 days, 28 days of curing. After curing, three cube specimens were tested on a compression machine. The specimens were tested in the compression testing machine of 2000kN capacity. After keeping the specimens on the compression testing machine, the load was applied at a uniform rate of 140kg/cm2/min until the failure of the specimen. The average value of the three results was taken as the compressive strength.

TABLE II
COMPRESSIVE STRENGTH

S.No	% Replacement	Strength (N/mm2)	
		7 day	28 day
1	0	17.22	29.62
2	5	19.26	31.35
3	10	17.24	28.65
4	15	16.60	24.63

B. Split TensileStrength

Tensile strength of concrete greatly affects the extent and size of cracking in concrete. Tensile strength of concrete is less when compared with its compressive strength. Cylinders of diameter 150mm and height 300mm were used to determine the split tensile strength. After curing, the specimens were tested on the compression testing machine.

Table III
SPLIT TENSILE STERNGTH

	% Replacement	Strength (N/mm2)	
		7 day	28 day
1	0	2.20	4.00
2	5	3.46	4.13
3	10	2.10	3.82
4	15	1.95	3.54

C. Flexural Strength

The flexural tensile strength at failure is called modulus of rupture. The knowledge of modulus of rupture is useful in the design of pavement slabs, airfield runways, finding deflection and crack width as flexural tension is critical in these cases. Prisms of size 100 mm X 100 mm X 500mm were used to determine the flexural strength. Two point loading was adopted for finding the flexural strength. The specimens were tested in a Flexural Testing Machine.

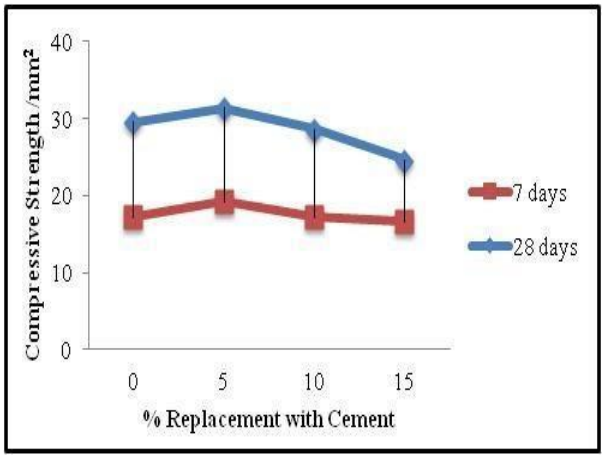

Fig. 1. Compressive Strength at 7 and 28 days

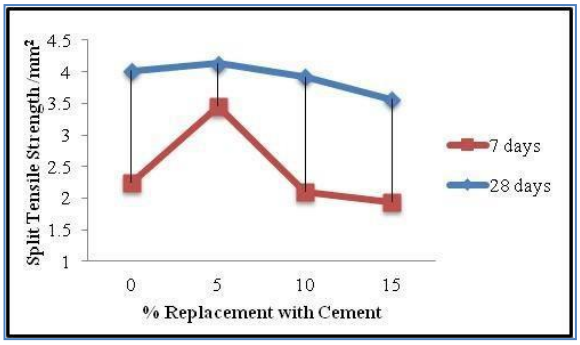

Figure 2. Split Tensile Strength at 7 and 28 days

TABLE IV
FLEXURAL STRENGTH RESULT

	% Replacement	Strength (N/mm2)	
		7 day	28 day
1	0	5.36	8.42
2	5	6.54	8.65
3	10	5.46	8.21
4	15	4.32	7.54

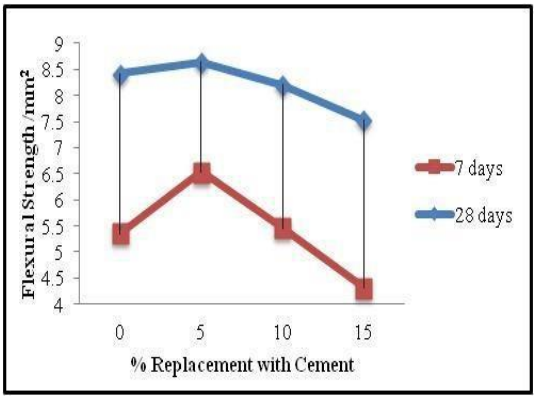

Fig. 3. Flexural Strength at 7 and 28 days

From the tables and figures, it can be seen that aglime powder improves the compressive strength, the split tensile strength and the flexural strength of concrete up to certain replacement percentage and then decrease. The maximum compressive and flexural strengths are obtained when the replacement percentage is 5%. The maximum compressive strength obtained at 5% replacement was found to be 31.35 N/mm2. The maximum split tensile strength at 5% replacement was 4.13 N/mm2. The maximum flexural strength at 5% replacement was
8.65 N/mm2.

IV. CONCLUSION

Replacement of cement with aglime powder is found to improve the strength of concrete. The optimal replacement percentage of cement with aglime powder is found to be 5% and at this replacement level, the maximum increase in the 28th day compression and flexural strength were found to be 5.83% and 2.72% respectively. In case of split tensile strength, the optimal replacement is 5% and at this replacement level, the percentage increase in split tensile strength was found to be 2.74%.

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