

EXPERIMENTAL STUDY ON CEMENT AND LIME MORTARS USING NATURAL ADMIXTURES LIKE KADUKKAY AND JAGGERY

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ABSTRACT - Cement has been used as the major construction material. Lime is arguably the world first true green and versatile building material. With the introduction of Portland cement during the nineteenth century the use of lime mortar in new constructions gradually declined, largely due compressive strength. Now-a-days various chemicals are used as admixture to improve the strength and performance of concrete. The cement and chemicals used in modern construction causes environmental pollution and its effect is significant. But a variety of plants and animal products used in traditional lime mortar not only improves the strength but also proves its durability for centuries. It also helps to retrieve the traditional concept of addition of admixture to concrete. In this experimental study, the compressive strength and permeability parameters of the cement and lime mortar using natural admixtures like kadukkay and jaggery in different proportions are studied.. The natural admixtures that are found to improve the strength are "Terminaliachebula" (kadukkay). Jaggery is the product of sugarcane which contains large amounts of minerals. The proportions of admixtures (kadukkay and jaggery) are simultaneously varied from 10%, 20%, 25%. The results show that the addition of admixtures improved the strength and impermeability of cement mortar and lime mortars at 20%.

KEY WORDS: Compressive strength, Jaggery, kadukkay, permeability.

1. INTRODUCTION

The materials used in the ancient period were enviro friendly, stable in a wider range of environmental conditions whereas the present synthetic materials are stable within the specified conditions. This could be one of the possible reasons why ancient structures are still in good shape, confirming the durability of these structures which used natural biopolymers from selected plant and fruit extracts. Kadukkay has powerful binding property and desirable hardening properties. The dried kadukkay is made in powder and added to cement/lime. Jaggery water extracted from sugarcane has very good bonding properties. In earlier days of constructions, kadukkay powder and Jaggery water are used in preparation of mortars.

2. METHODOLOGY

The materials used in this investigation are:

OPC 53 Grade (Conforming to IS: 12269-1987) is used. Hydraulic Lime with specific gravity of 2.5 is used and formula of lime is Ca Mg (OH)_2 , CaCO_3 , Al_2O_3 , 2SiO_2 . Ennore sand of Grade I, II, and III are used as fine aggregates. The sand used is free from clay, silt and other organic impurities. Specific gravity is about 2.60, water absorption is 0.8%, the water used for mixing is clean and free from impurities conforming to clause 5.4 of IS: 456-2000.

Kadukkay is naturally available fruit which has hardening properties. Kadukkay powder is used as admixture in cement mortar and lime mortar in proportions of 10%, 20% and 25%. Jaggery water collected from sugarcane industry is used as a admixture in cement mortar and lime mortar in proportions of 10%, 20% and 25%.

3. EXPERIMENTAL PROCEDURE

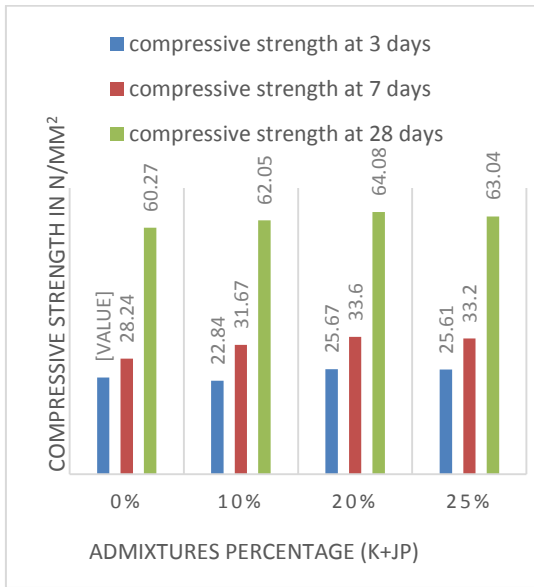
In normal cement mortar mix 1:3 (cement: sand) are used. In normal lime mortar mix 1:3 (lime: sand) are used. Kadukkay powder and Jaggery water are simultaneously added to cement mortar in proportions of 10%, 20% and 25%. Cement mortar mix is denoted as CM0, CM1, CM2, CM3. Similarly, Kadukkay powder and Jaggery water are simultaneously added to lime mortar in proportions of 10%, 20% and 25%. Lime mortar mix is denoted as LM0, LM1, LM2, LM3. Mortar cubes of size $7.07 \times 7.07 \times 7.07$ cm are casted using vibration table. The compressive strength of these cubes are obtained at the age of 3 days and 7 days, and 28 days after curing for cement mortar and 3 days, 7 days, 14 days and 28 days of curing for lime mortar. Permeability test are conducted at the age of 28 days of curing cement and lime mortar.

4. RESULTS AND DISCUSSION

The cubes were tested in compressive strength machine at the age of 3 days, 7 days and 28 days of cement mortar with natural additives like kadukkay and Jaggery.

TABLE1. Compressive strength of cement mortar.

Mix	Compressive strength N/mm ²		
	3 days	7 days	28days
CM0	23.64	28.24	60.27
CM1	22.84	31.67	62.05
CM2	25.67	33.6	64.08
CM3	25.61	33.2	63.04



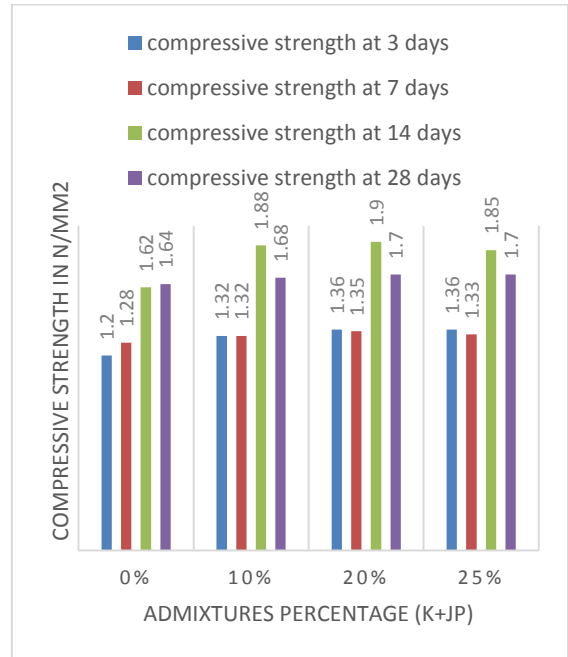
GRAPH1. Compressive strength of cement mortar

Graph 1 shows that there is increase in compressive strength at 20% of kadukkay and Jaggery compared to the remaining percentage of admixtures.

The cubes are tested in compressive strength machine at the age of 3 days, 7 days, 14 days and 28 days of lime mortar with natural additives of kadukkay and Jaggery.

TABLE2. Compressive test of lime mortar.

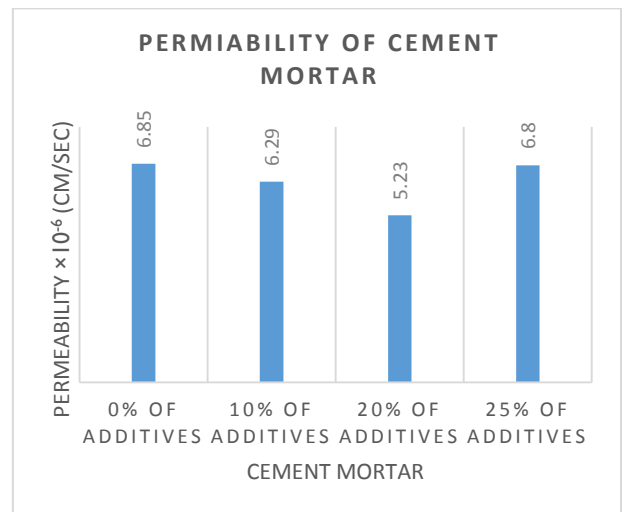
Mix	Compressive strength N/mm ²			
	3 days	7 days	14 days	28days
LM0	1.2	1.28	1.62	1.64
LM1	1.32	1.32	1.88	1.68
LM2	1.36	1.35	1.9	1.7
LM3	1.36	1.33	1.85	1.7



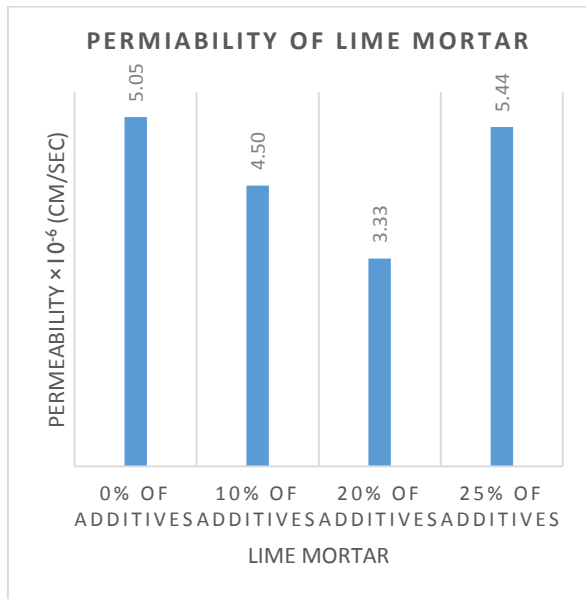
GRAPH 2: Compressive strength of Lime Mortar.

Graph 2 shows that there is increase in compressive strength at 20% of kadukkay and Jaggery when compared to the remaining percentage of admixtures.

After 28 days of curing, cement and lime mortar cubes were allowed to test the permeability and the results are shown graphically.



GRAPH3: Permeability of cement mortar



GRAPH4: Permeability of lime mortar

5. CONCLUSIONS

- At the age of 3days, 7 days and 28 days compressive strength of CM2 cubes has maximum increase of 8.58%, 18.98% and 6.32%.
- At the age of 3days, 7days, 14 days and 28days compressive strength of LM2 cubes has maximum increase of 13.6%, 5.47%, 17.28% and 3.66%.
- At the age of 28days, permeability of CM2 cubes has a maximum decrease of 23.65%.
- At the age of 28days, permeability of LM2 cubes has a maximum decrease of 41.43%.
- In all respects, maximum gain in strength and maximum decrease in permeability is obtained in CM2 and LM2 cubes.

6. REFERENCE

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