

# EXPERIMENTAL STUDY ON LIME MORTAR BY USING ADMIXTURES

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**Abstract** - Lime is a binder material which is used from ancient years for the construction purpose. The strength of lime as compared to cement is less but the usage of cement in the recent construction is huge quantity due to environmental effect. There is a need to reduce the use of cement in the construction industry. This paper presents improves the strength of the lime mortar by using ancient year used natural admixture and newly added replacement material.

In this paper we are used sugar water and Aloe vera as the natural admixture and fly ash and glass fibre as a replacement material in the lime mortar. The compressive strength of varying proportion of admixture and replacement materials are find out by experimental study and the values are compared with normal lime mortar. The proportion of admixture and replacement material is varied from 5%, 10%, 15%, 20%, 25%. The results are show at the newly added replacement material improved the strength as compared to ancient year used natural admixture.

**Key Words:** Lime, Aloe vera, Herbs, Fly Ash, Glass fibre.

## 1. INTRODUCTION

Introduction of Portland cement during the 19<sup>th</sup> century the use of lime mortar in new construction slowly declined, mostly due to Portland's ease of use, quick setting and compressive strength. Lime possesses greater qualities such as stickiness, ease of applications, self-healing, durability, and low thermal conductivity, incombustible. The traditional lime binder offers greater durability but less strong compared to cement. Fine aggregate of natural river sand from a local supplier was used for the Mortar cube & their properties, such as Specific gravity, Fineness modulus, water absorption.

Now-a-days various chemicals are used as admixture to improve the strength and performance of mortar. The cement and chemicals used in modern construction causes environmental pollution and its effect is significant. The materials can be used as admixtures like Herbs & Sugar water used in traditional lime mortar not only improves the strength but also improves its durability for centuries. It also helps to recover the traditional concept of additional of admixture to Mortar. By shifting ourselves to

use such eco-friendly admixtures in mortar will lead the construction industry towards sustainable development.

The study of mechanical properties of lime mortar by replacing fly ash & glass fibre in percentage & use the admixtures like Herbs, Sugar water. The mechanical properties studies to the compressive strength and durability test of lime mortar. Also find the best possible percentage of replacement fly ash & glass fibre to lime and use admixtures for achieve the economy.

## 2. MATERIALS LIME

Lime is confirmed in IS 712-1984. Lime is generally considered to be more environmentally friendly than cement.

**Table1: Setting time of lime**

Test	Result
Initial setting time (2 hrs)	3 mm
Final setting time (48 hrs)	36 mm

## FINE AGGREGATE

Aggregate most of which is passes through 4.75 mm IS Sieve is known as fine aggregate. Fine aggregate consist of natural sand conforming to IS 1542-1977. The physical properties of aggregate are specified in table 2. It shall be hard, durable, chemically inert, clean & free from adherent coating organic matter. The percentage of all type deleterious material in fine aggregate should not exceed 5%.

**Table2: Properties of Aggregate**

Test Name	Result
Sieve analysis	2.20
Specific gravity	2.24
Water observation	2%

## Fly Ash

According to ASTM, class F fly ash normally produced from burning anthracite or bituminous coal that meets the applicable requirement for this class. This class of fly ash is pozzolanic properties class C fly ash is normally produced from lignite or sub bituminous coal that meets the applicable requirements. This class of fly ash having pozzolonic properties also has some cementations properties. Fly ash used for as per IS 3812-1981.

## GLASS FIBER

It is a material made up from extremely fine fibre of glass; Glass fibre possesses high strength and stiffness. Their low density, resistance to chemical, insulation capacity is other addition characteristics. Glass fibre is a light weight, extremely strong & robust material. Although strength properties are somewhat lower than carbon fibre and it is less stiff, the material is typically far less brittle and the raw materials are much less expensive. Its bulk strength and weight properties are also very favorable when compared to metals and it can be easily formed using moulding process. Glass is the oldest, the most familiar performance fibre. Glass is able to sustain loads for many months or year continuously.

## SUGAR WATER

Sugar is used as admixture in the mortar production. White crystalline solid is readily soluble in water and available in market will used in the experimentation work. The property of the sugar is adhesive, binding agent, coating, and stabilizer.

## HERBS (ALOEVERA)

It is soluble in water. Aloe vera can be added with lime mortar during the conduct of experiment it is seen that herb lime mortar under goes more deflection without cracking on the application of load. This indicates the flexible nature of lime mortar. Hence it is expected to perform better under seismic attack.

## 3. PREVIOUS RESEARCH WORKS

### 1. Study on the Compressive Strength of Lime Mortar Using Admixtures

- The compressive strength of varying proportion of admixture is found out by experimental study and the values are compared with conventional lime mortar.
- 25gms of Jaggery is mixed with 1000ml of water in lime mortar.
- The mix proportion of 1:3, The maximum compressive strength of lime mortar obtained at 10% of Jaggery at 28 days is found to be 3.71 N/mm<sup>2</sup> and 2.34 N/mm<sup>2</sup> for 10% of Kadukkai.

### 2. Review on Herbs used as Admixture in Lime Mortar used in Ancient Structures

- In this paper the herbs used in traditional construction and its role in modifying the fresh and hardened properties of lime mortar. It also helps to retrieve the traditional concept of additional of admixture to concrete. By shifting ourselves to use such eco-friendly admixtures in mortar will lead the construction industry towards sustainable development.
- Similar to chemical admixture in modern construction, herbal admixture had been added in traditional construction. The herbs were used in lime mortar is subjected to its local availability.

### 3. Experimental Study on Mortar Using Natural Admixtures

- The natural admixture gives the power full binding property & desirable hardening property. Most of the ancient structure in olden days is constructed by using admixture Jaggery water & kadukkai.
- The mix Proportion adopted is 1:3. The mix proportion by varying the proportion of Jaggery and kadukkai. The Jaggery proportion are 0%, 25%, 50%, 75% and 100%.
- The use of Jaggery water 75% is optimum for the compressive strength.

### 4. Study on the performance enhanced of lime mortar used in ancient temples and monuments in India

- The strength parameters of lime using traditional herbs. Mix proportion ratio 1:2 respectively in comparison.
- Lime mortar with 5% herbal juice provides greater flexural, tensile and compressive strength are increased as comparison with plain lime mortar.

### 5. Experimental Study on Lime Mortar using Fly ash and Gallnut as Additives

- From this paper we are used proportion of jaggery as a sugar water in the proportion of 5%, 10%, 15% weight of binder.
- Lime mortar with 5% herbal juice provides greater strength. The compressive strength are increased by 55% as compared to plain lime mortar.

## 4. METHODOLOGY

In this project, the following methods are to be used as,

**MIX DESIGN AND PROPORTION**

The mix proportion adopted 1:2 and water lime ratio is 0.56. The lime mortar using admixtures like Herbs and sugar water 5%, 10%, 15%. In the lime mortar glass fibre 5%, 10%, 15% and fly ash 15%, 20%, 25% are replaced respectively. Then the compressive strength compared with normal lime mortar.

**PREPARATION OF LIME MORTAR**

- ❖ Mix all the elements by chisel.
- ❖ Mix the all admixtures and replacements in required proportions.
- ❖ Add portable water as per requirement.
- ❖ Mixing the wet mixture at 10 -15 minutes.

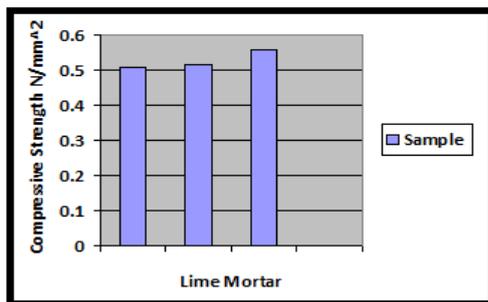
**CASTING OF SPECIMEN**

After proper mixing of all the materials the mixture is then fill in the mould 7.06 cm x 7.06 cm x 7.06 cm with alternately tamping is carried out. Compaction of fresh lime mortar in the steel moulds was achieved by applying twenty five manual strokes per layers in three equal layers.

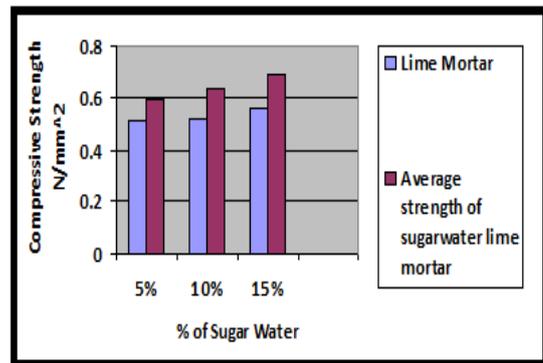
**5. RESULTS AND DISCUSSION**

The blocks were tested in the Universal Testing Machine (UTM) to determine the compressive strength for 28 days. The results are compared to normal lime mortar.

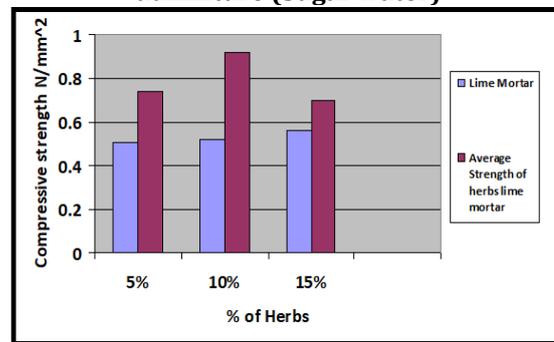
The acid resistance test were carried out on 7.06 cm x 7.06 cm x 7.06 cm size, Cube specimen was weighted and immersed in water diluted with one percentage with weight of sulphuric acid for 120 days and to check the durability of lime mortar. Various graphs are shown below of lime mortar.



**Graph1: Compressive Strength of lime mortar**



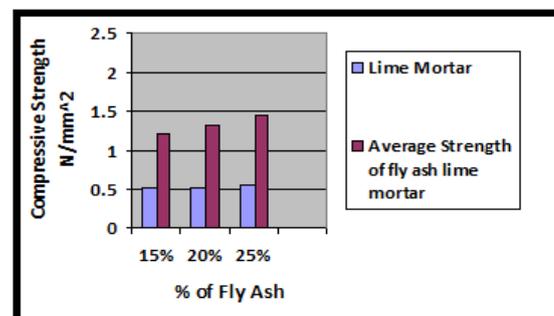
**Graph2: Compressive Strength of lime mortar by using admixture (Sugar water)**



**Graph3: Compressive Strength of lime mortar by using admixture (Herbs)**



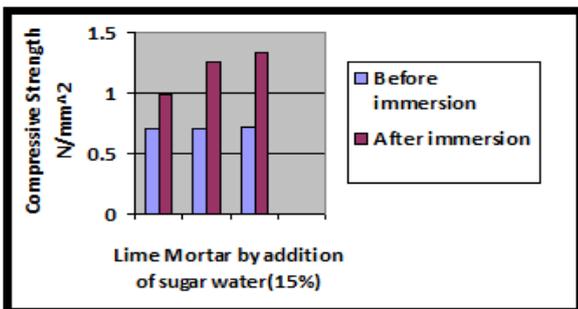
**Graph4: Compressive Strength of lime mortar by using admixture (Glass fibre)**



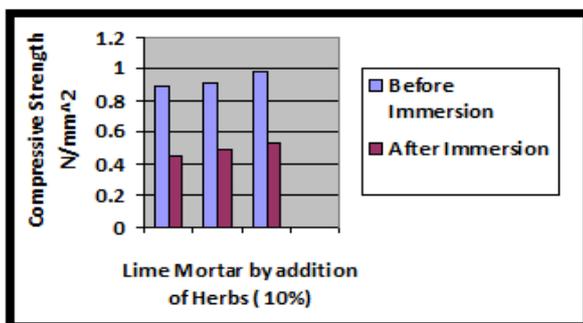
**Graph5: Compressive Strength of lime mortar by using admixture (Fly ash)**



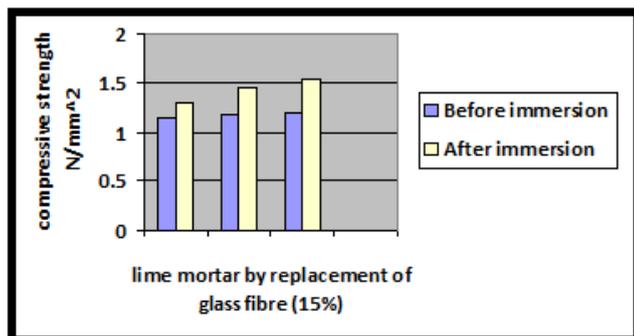
Graph6: Compressive Strength of lime mortar immersed in sulphuric acid



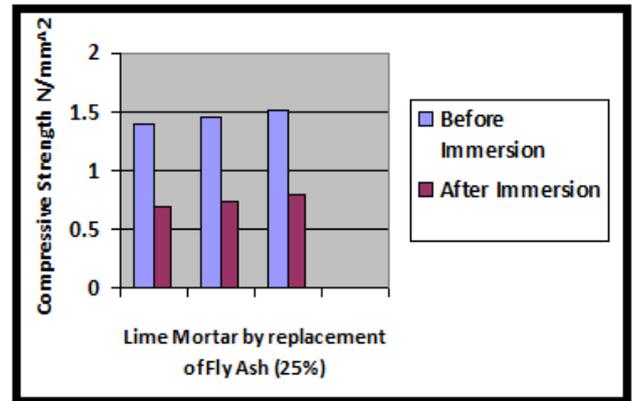
Graph7: Compressive Strength of lime mortar and replaced sugar water (15%) immersed in sulphuric acid



Graph8: Compressive Strength of lime mortar and replaced herbs (10%) immersed in sulphuric acid



Graph9: Compressive Strength of lime mortar and replaced glass fibre (15%) immersed in sulphuric acid



Graph10: Compressive Strength of lime mortar and replaced fly ash (25%) immersed in sulphuric acid

## 6. CONCLUSION

After reviewing all the prior researches, we can conclude that the compressive strength of lime mortar is an avg. 30% more after adding glass fiber, fly ash, sugar water and herbs than normal lime mortar. In the durability test, the acidic attack on lime mortar, it becomes less strength or less resistivity.

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