International Journal of Innovative Research in Engineering & Management (IJIREM)
ISSN: 2350-0557, Volume-9, Issue-4, August 2022
https://doi.org/10.55524/ijirem.2022.9.4.2
Article ID IRP1228, Pages 6-8
www.ijirem.org

Study On Lime Mortar with Complex Urea and Superphosphate

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ABSTRACT- Lime mortar is as old as human civilization. But Lime is replaced with Cement as binding material which is widely utilized today. But need for reduction in environmental pollution is turning the tide against cement. Lime with admixtures are tried in various researches nowadays. In this paper lime mortar of 1:3 ratio is with admixtures of Agricultural complex (NPKS) urea and Super phosphate in various percentages such as 1, 2, 3, 4 and 5 is studied. Commercial lime available in market was used. Red soil was used as fine aggregate. The Raw materials are tested for physical and chemical properties. Lime mortar cubes were cured in ambient temperature with moisture. The lime mortar cubes were tested for strength, water absorption and weight. Maximum strength was obtained in urea 4% and 5%.

KEYWORDS – Lime Mortar, Redsoil, Complex Urea, Superphosphate.

I. INTRODUCTION

Lime mortar is made up of lime and fine aggregate such as sand, mixed with water. Lime mortar is being used since time immemorial. Buildings with lime mortar are very common in ancient India. From Rajasthan to Chettinad of Tamilnadu has their own unique lime mortars. With advent of Portland Pozzolana cement, lime has been reduced in usage, but still used in renovation works and people who want ecofriendly construction, lime mortar with local soil or sand is their first choice. Lime mortar is the most durable material manufactured by humans. The monuments made with stone and lime mortar are still standing even after hundreds of years.

Historically a number of other unusual materials were sometimes added to mortars to enhance their properties. Urine and beer could be added to mortars on site to increase workability and improve frost resistance. Additionally, urine is thought to act as a retarder in lime plaster, giving more time for it to be worked and moulded. Little research has been carried out in this area and the exact mechanisms at play are unknown. It may be the case that these materials introduce natural polymers into the mix, changing the mortars' properties or they may simply introduce entrained air, effectively lightening the mix.

Red soil is clayey and organic soil prominently made naturally by weathering of metamorphic rock. It contains high amount of iron oxide. It is traditionally used along with lime to create lime mortar for low cost houses.

Gypsum is a particularly useful processed material. Its main application is as a building material, mostly produced as so – called plaster of Paris for plastering walls and making decorative features in buildings. It is main ingredient in cement. It forms 5% of cement which helps in delaying the initial setting time to 30minutes. In lime mortar it is used as a anti-shrinkage agent.

A complex urea is a three-component fertilizer containing nitrogen, phosphorus and Sulphur. It is used in soils with low phosphorus content.

Superphosphate is the first chemical fertilizer. It was first made in about 1840 from bone meal and sulfuric acid. It is also used in soils with low phosphate and Sulphur content.

II. LITERATURE REVIEW

The strength of lime is very less compared to cement, but due to environmental aspects, there is a need to reduce the usage of the cement in the construction industry. Hence many works are going on to create admixtures for lime which may improve its properties and that may be sustainable without any major impact to the environment. The natural admixtures such as kadukkai and Jaggery are found to improve the strength by 30% [1]. 10% of Milk [2] has proved to have positive effect on mortar properties. Milk improves the properties of the lime mortar. 3% Urea [3] shows better strength with Fly Ash Lime gypsum (FAL-G) composite than with lime mortar. sticky rice [4] when used as admixture improves microstructure and consolidation properties of lime mortar, enhances high adhesive strength, good toughness, water-proofing, etc. proteins [5] work as an air entraining agents, improved the adhesiveness and hydrophobic property. starch [6] alters slump value, air content, density, water retention capacity, setting time. Black gram [7] acts as air entraining agent, has improved the adhesiveness and hydrophobicity of cement mortar and concrete. egg white [8] improved the compression and flexural strength of the lime mortar until 6% egg whites. The areca nut [9] (Areca catechu) extract with lime mortar improves workability, mechanical resistances and durability. Lime mortars with blood [10] show increased resistance to water action, weather resistance and curing speed.

III. RESEARCH METHODOLOGY

Commercial lime of 85% CaOH, Red soil of specific gravity 2.66, fineness modulus 3.25 and water of TDS 35 ppm and ph 7.0, were used to prepare lime mortar mix. Commercial Lime of 30%, local red soil 65%, gypsum 5% of weight of lime is taken and dry mixed thoroughly. 60% of water is added to dry mix. The Complex urea and superphosphate were added in various percentages such as 1,2,3,4 and 5. The complex urea or Superphosphate first dissolved in the water then added to dry mix. The wet mix was Cast in 50sq cm

moulds and allowed to cure in ambient conditions with regular sprinkling of water.

IV. RESULTS AND DISCUSSIONS

- The unit weight of specimens hovers between 1.6 - 1.8(figure 1)
- The Water absorption is above 16% for Complex Urea 4 and Superphosphate 1 and Superphosphate 2 (figure 2)
- Maximum compressive strength is given by Complex Urea 5 and Complex Urea 4. (figure 3)
- Complex urea 2% and3% lime mortar show lowest compressive strength results and also lowest water absorption which may be anomaly.(Table 1).

Table 1: General Test Scenario of ATM machine Generation

cubes	Unit weight	Percentage	Comp strength
Plain	1.68	13.4	2.2
Urea 1	1.75	14.4	2.21
Urea 2	1.8	9.65	1.23
Urea 3	1.82	9.38	1.14
Urea 4	1.73	17.13	9.31
Urea 5	1.76	11.83	15.66
Super phos-1	1.74	17.06	4.56
Super phos-2	1.7	17.73	5.23
Super phos-3	1.76	15.2	6.59
Super phos-4	1.77	15.6	4.55
Super phos-5	1.84	14.02	5.91

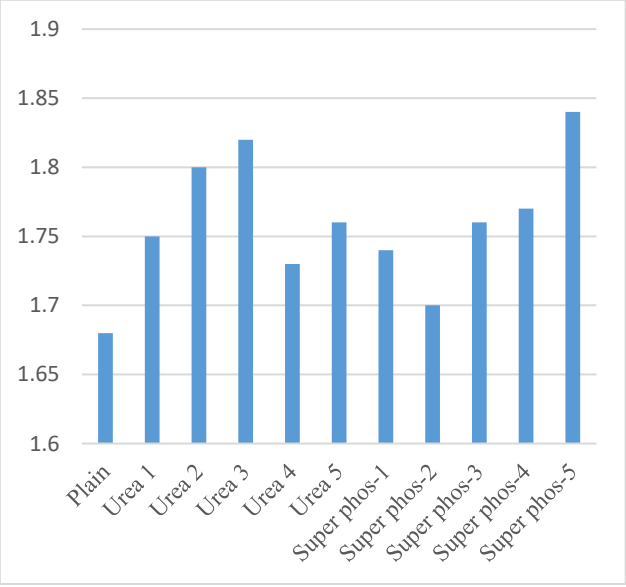

Figure. 1: Unit weight in Gms/CC

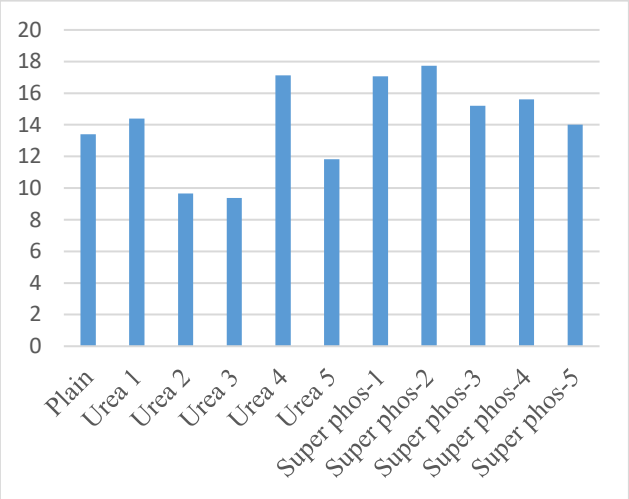

Figure. 2: Water Absorption in Percentage

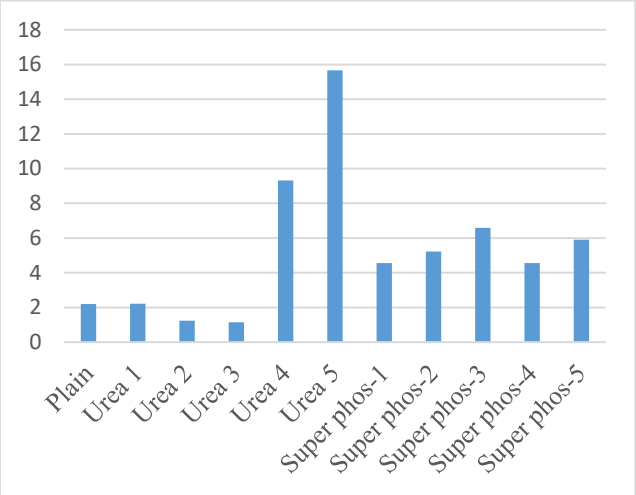

Figure. 3: Compressive strength in N/mm2

- The Complex Urea 5, Complex Urea 4 and Super phosphate 3 cubes show strength higher than class designation 5 of IS 1077: 1992 (Reaffirmed 2002).
- The water absorption of all cubes is within 20% which conforms to water absorption limit for first class fired clay bricks.
- All the lime mortar with superphosphate percentages showed 2-3 times the strength of plain lime mortar mix.

V. CONCLUSION

This study is in continuation with work [3]. The lime mortar and FAL-G (Fly ash lime gypsum) shown improvement in compressive strength from 1% to 3%. But in this study, lime mortar has shown improvement in compressive strength with complex urea 4% and 5%and all the percentages of superphosphate. The complex urea and superphosphate doesn't affect the unit weight very much. Except Complex Urea 2% and 3% show increased water absorption as compared to Plain lime mortar. Superphosphate can be added to lime mortar without hesitation as all percentages show improved compressive strength as compared to plain lime mortar mix. Super Phosphate is better admixture than complex urea.

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