

A Review on Enhancing the Water Resistance Property of Gypsum

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Abstract: This review is based on the enhancing the water resistance property of powder gypsum by adding some materials like silica powder and glass powder so as to use this gypsum on inner as well as outer side of walls of building. Also to make it cost efficient.

Keywords: Gypsum, Water resistance, glass powder, silica powder.

1. Introduction

In the recent years the gypsum products are widely used in all over the world. In the many countries the gypsum is used as an internal plastering material. Gypsum is a naturally occurring material. Chemically Gypsum is calcium sulphate dihydrate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ which is been found in a mineral form. It is widely mined and can be used as a fertilizer. Gypsum is also formed as a by-product of sulphide oxidation, amongst others by pyrite oxidation, when the sulfuric acid generated reacts with calcium carbonate. Gypsum possesses many of the properties such as obtainable availability of in-expensive raw materials, volumetric stability, acoustic and thermal isolation, fire resistance, quite low toxicity, if it been compared with the cement then all the properties of gypsum withstand with the cement except water resistance and strength. So, to overcome this property we need to use some additives in the gypsum. Previously some additives added that are, Silica fume, Silres BS powder, wax emulsion, fatty acids etc.

Cured gypsum mortar consists of 50-60% volume of pores, most of them having a porous size between 0.3-1.0 μm . this means that porous in gypsum matrix have diameters, where capillary suction forces are active. The high content of this micropores, the water solubility of gypsum and the relative large gypsum crystals are factors, which highly contribute to the water sensitivity of such building materials. When exposed to water or high humidity gypsum based materials can be severely damaged.

2. Literature review

A. Introduction

It provides the detailed review of literature related to the improvement of water resistance property of the gypsum. In this literature the detailed information about the gypsum, its

properties as well as the methodology, materials used by the previous researchers are included.

Literature 1: Konstantin Kovler 2001 - "Enhancing Water Resistance of Cement and Gypsum-Cement Materials" In this paper author gives the information about the enhancing the water resistance of cement and cement-gypsum materials using the silica fume. He gives the detailed information about the materials, proportions that should be adopted. He carried out the test on dry/wet samples. He carried out the compressive strength test on the samples because he concluded that the ratio between the compressive strengths of wet and dry state usually accepted as a characteristics of water resistance. The study indicates the use of the waste material in the construction work.

Literature 2 : R. Eires, A. Camões & S. Jalali 2004 – "Eco-friendly construction materials using gypsum and industrial wastes" In this paper author gives the information about preparing eco-friendly construction materials by using gypsum and industrial waste. In this report he used granulated cork, cellulose fibres, tyre fibres as the additive industrial waste with the gypsum. He performed the water absorption test according to Portuguese standard. He also performed the compressive strength test, flexural strength. He concluded that by using these materials it reduces their mechanical performance but it is possible to reduce significantly the water absorption.

Literature 3 : T. Aberle, P. Emmenegger, F. Vallée, L. Herschke-2010- "New Approaches to Increase Water Resistance of Gypsum Based Building Materials" In this paper it states that the interior application of gypsum are more than the exterior applications, because of the less resistivity to water of gypsum. so that by using some hydrophobizing additives such as, fatty acids, wax emulsion, alkyl silicon resin, alkyl oxy silanes etc. this will significantly reduce water uptake and achieved jointing compound through that increase application of gypsum on exposed weather.

Literature 4: Dr. Ahmad S. D. Al-Ridha, Ali A. Abbood, Hussein H. Hussein 2015- "Improvement of gypsum properties using S.F. additive" In this paper author describes about improving the properties of gypsum by using silica-fume additive. In this paper different properties of gypsum like porosity, compressive strength, bulk density is increased with addition of silica fume with gypsum on different water gypsum ratio. If water gypsum ratio increased compressive strength and

bulk density reduced and porosity increased. If water gypsum ratio decreased compressive strength and bulk density increased and porosity decreased.

Literature 5: Mengmeng Zhang, Mimi chen, Tieli Fan & Fengqing Zhao 2015- "Improvement water proof property of gypsum block with organic-inorganic compound materials" In this paper author gives an information about efficient approach to utilize manganese slag, typical solid waste in metallurgical industry as a material to increase water resistance capacity. Water proofing material for gypsum in this paper is methyl silicon alkoxide, due to this water resistance and mechanical strength of gypsum product improved by combine use of organosilicon (methyl silicon alkoxide) and inorganic material (cement, manganese, slag powder). The combine use of organosilicon with inorganic material cannot only solve the problem of poor water resistant of gypsum product, but also increase the mechanical strength of composite material.

Literature 6: G.N. Pervyshin, G.I. Yakovlev, A.F. Gordina, J. Keriene, I.S. Polyanskikh, H.-B. Fischer, N.R. Rachimova, A.F. Buryanov 2017- "Water-Resistant gypsum composition with man-made modifiers" In this paper study of continuously adding various manmade additives like blast furnace slag, ceramist dust, Portland cement, lime and super plasticizer. These additives lead to increase the physical and chemical properties of conventional gypsum product. By this hydration and setting of gypsum it will improve its improve performance. Finally, the outcome of adding various additives the properties of gypsum are improved such as density, durability and also slightly water resistance.

Literature 7: A.A. Khalil, A. Tawfik, A.A. Hegazy 2018 – "Plaster composites modified morphology with enhanced compressive strength and water resistance characteristics" In this paper author gives the information about plaster composites modified morphology with the enhanced compressive strength and water resistance characteristics using the additives like natural sand, silica fume, silica gel, rice husk, ground granulated blast furnace slag, calcium carbonate or commercial poly vinyl acetate polymer. He prepared the samples by blending plaster with wt.% of each additive. After curing for 14 days, by using XRD and FTIR observed and correlate their microstructure. He observed that the plaster composites not only stopped deterioration due to water immersion but also slightly improved water resistance.

Literature 8: Som Pidiha, Dr. Sanjay Kumar Singh 2018 -"Analysis of chemical and physical properties of water resistant gypsum in cement concrete". This paper gives an outline of the process of hydration, dehydration and setting of gypsum of the various admixture on gypsum. This paper is also concerned with effect of different types of fibres on gypsum. The new gypsum based construction material with improved thermal storage capacity and fire protection is possible with combination of phase changing material with conventional gypsum. These phases changing materials with gypsum can be used to reduce the energy consumption in building maintaining

thermal comfort. This paper tries to glean out the previous experimental and analytical studies on gypsum that will serve as a tool for future research work.

Literature 9: IS Code- IS : 2542 (Part II/Sec 1 to 8) – 1981- Methods of test for gypsum plaster, concrete and products- With the help of this, methods of test for gypsum plaster is carried out. *Literature 10:* IS Code- IS : 1288-1982 – Methods of test for mineral gypsum- With the help of this, test on the mineral gypsum are determined.

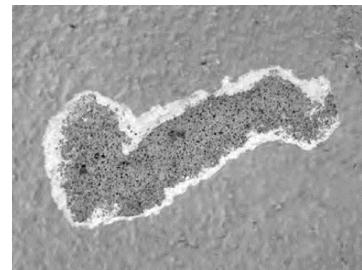


Fig. 1. Water damaged gypsum plaster

3. Scope of the work

- It would completely or partially replace the conventional method of sand plastering.
- Gypsum plastering decrease the time required for conventional plastering.
- Conservation of natural sand can be done by using gypsum.
- Plastering efficiency can be increase by using the gypsum plaster.
- Moisture resistance of gypsum can be done

4. Conclusion

This paper presented an overview on enhancing the water resistance property of gypsum.

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