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Assessment of Durability Properties of Concrete Made with Jarosite

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ABSTRACT

. The hardened properties of jarosite concrete were tested in this study, including compressive strength, split tensile strength, and rate of water absorption properties. By weights, the percentages of jarosite that were partially and entirely replaced by fine aggregates were 0 percent, 01 percent, 20%, 30%, 40 percent, and 50 percent. Experiments were carried out on both ordinary concrete and jarosite concrete with various jarosite percentages. The compressive strength of concrete and the splitting tensile strength of concrete increase with the addition of a low percentage of jarosite, according to the experimental results and analyses.

Keywords: - Workability, Jarosite, Design Mix, Compressive Strength, Split Tensile Strength, Csat.

1. INTRODUCTION

The modern world is witnessing the creation of extremely demanding and challenging civil engineering structures. Concrete, as the most essential and commonly used material, is frequently required to have extremely high strength and workability attributes. In the field of concrete technology, efforts are being undertaken to generate such concretes with unique properties. Researchers from all over the world are seeking to build high-performance concretes by including jarosite particles in small amounts. Sustainable construction has become a major worry in terms of construction practices that jeopardize our planet's future. Lots of construction operations are taking place all around the world as cities develop and modernize.

2. LITERATURE REVIEWS

Gaur (2020) Jarosite is a hazardous industrial waste product that is created during the zincore extraction process employing hydrometallurgy. Because hazardous jarosite cannot be disposed of directly due to Indian government requirements, a nonhazardous material called jarofix is created by adding 2% lime and 10% cement to jarosite trash before disposal. Jarosite was replaced with portland pozzolana cement (PPC) in amounts ranging from 0% to 25% with a 5% gap. The results of the experiment showed that as the amount of jarosite in the cement concrete mix grows, the mechanical strength properties improve while durability properties like porosity and abrasion loss decrease. It can be concluded from this experimental study that jarosite has the ability to be replaced with cement to a certain extent. Mubiayi Mubiayi Mubiayi Mubiay (2020) There is a daily generation of wastes such as fly ash and jarosite all over the world, which might have a negative impact on the ecosystem. Many researchers have employed fly ash and jarosite to create items like as bricks and concrete for the construction industry. The properties of jarosite and fly ash are presented in this review work. It also outlines some of the research that has been done on the successful reuse of jarosite and fly ash as a component in various construction materials. It has been observed that using specific ratios in jarosite and fly ash-based bricks and concretes can result in good mechanical qualities such as compressive strength. More research is needed to determine the environmental friendliness and cost-effectiveness of products created with jarosite and fly ash as a component, due to the significant generation of wastes around the world.

3. MATERIALS AND METHODOLOGY

3.1 Cement

Throughout the experiment, ordinary Portland cement (OPC) from a single lot was used. Table 3.1 lists the physical parameters of the cement as determined by various tests that adhere to Indian Standard IS: 1489-1991(Part-1). All of the tests were carried out in accordance with IS: 4031-1988 guidelines. Cement was properly preserved to avoid its characteristics from deteriorating due to moisture interaction.

3.2 Fine aggregate

Fine aggregate is defined by IS 383-1970 as that which passes through a 4.75 mm IS sieve. A sand size aggregate is another name for fine aggregate. The current investigation employed locally available riverbed sand. According to IS: 383 – 1970, the sand falls under grading Zone – III. 1.75 was the specific gravity.

3.3 Course Aggregate

As coarse aggregate, crushed angular granite metal from a nearby source was employed. The coarse aggregate is defined as that which is retained on a 4.75 mm IS filter and has a specific gravity of 2.66. The coarse aggregate is typically utilized in 20mm sizes to boost the density of the final concrete mix.

3.4 Jarosite

Jarosite is a basic hydrous sulfate of potassium and ferric iron (Fe-III) with a chemical formula of $KFe_3(SO_4)_2(OH)_6$. This sulfate mineral is formed in ore deposits by the oxidation of iron sulfides. Jarosite is often produced as a byproduct during the purification and refining of zinc and is also commonly associated with acid mine drainage and acid sulfate soil environments. The specific gravity was 2.51. The Jarosite conforms to grading Zone – III as per IS: 383 – 1970 respectively.

4. RESULT AND DISCUSSIONS

4.1 Compressive Strength

This section presents and discusses the findings of compressive strength tests performed on concrete specimens of various mixes cured at various ages. The compressive strength test was performed at 7, 14, and 28 days after curing. Table 4.2 shows the compressive strength test results for all of the mixes at various curing ages. In Fig. 4.1, the variation in compressive strength of all the mixes cured at 7, 14, and 28 days is also displayed.

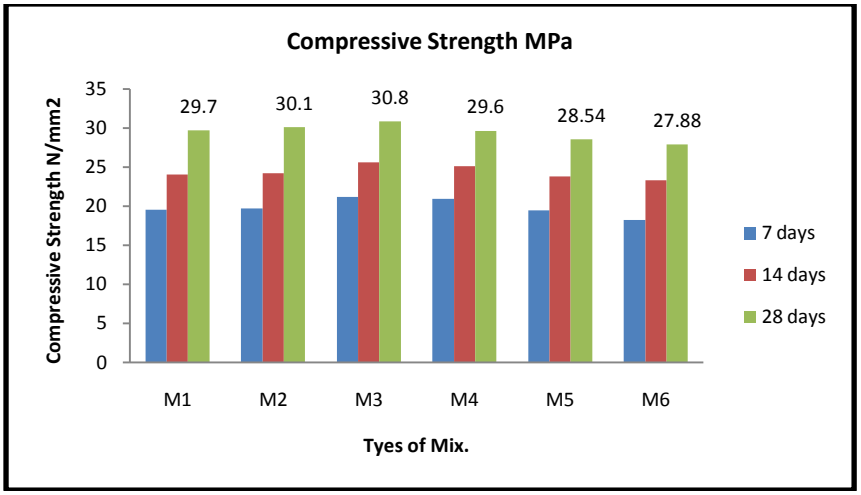
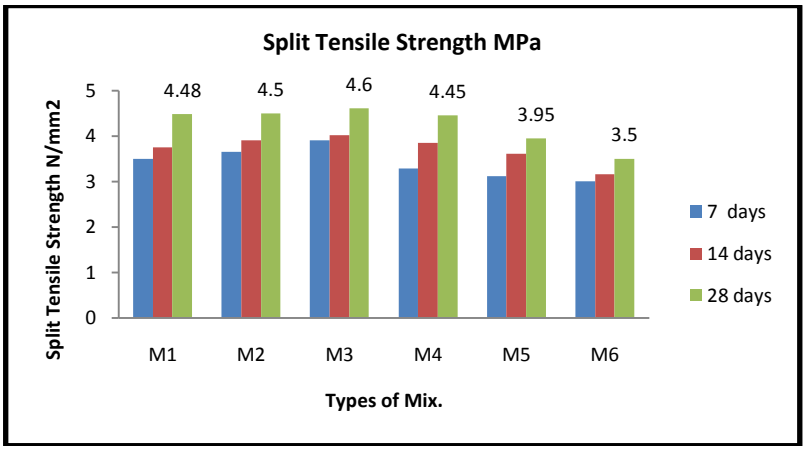


Fig 4.1. Variation in Compressive strength for all the mixes with curing ages.

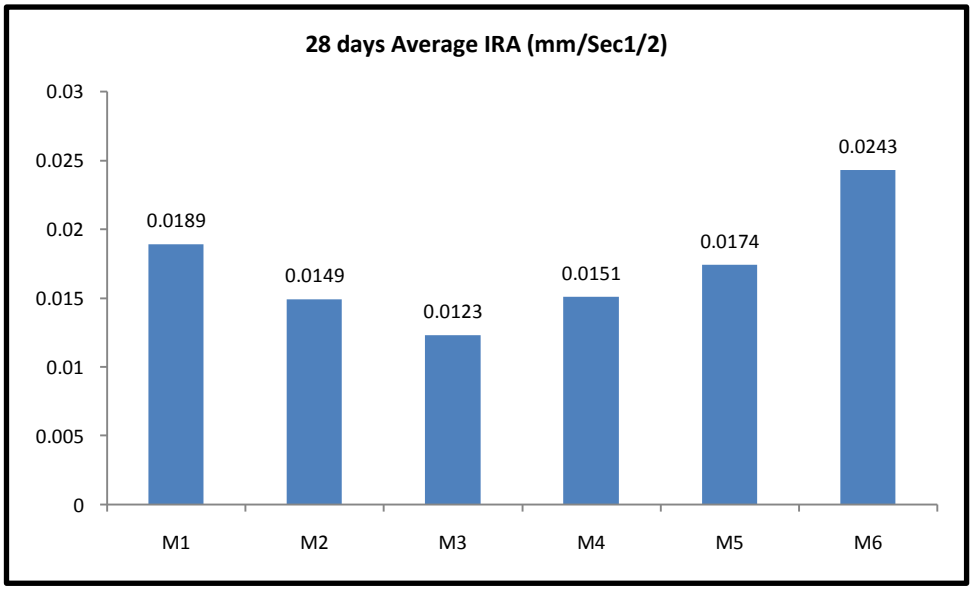
4.2 Split Tensile Strength results

This section presents and discusses the findings of splitting tensile strength tests performed on concrete specimens of various mixes cured at various ages. The splitting tensile strength test was performed at 7, 14, and 28 days after curing. Table 4.3 shows the splitting tensile strength test results for all the mixes at various curing ages. Fig. 4 shows the variation in splitting tensile strength for all the mixes cured at 7, 14, and 28 days. 2. Shows the difference in splitting tensile strength of concrete mixes compared to a control mix (100 percent FA+0 percent JS) after 7, 14, and 28 days.



3.3 CSAT Test

The rate of passage of a waterfront through a porous material under capillary action is known as sorptivity. The sorbtivity test differs from the ISAT in that the former assesses the rate of capillary suction, whilst the latter measures the bulk effect of capillary suction at a given period. The lower the sorptivity rating, the better the concrete's resistance to water absorption.



5. CONCLUSIONS

The following section presents the main conclusion which can be drawn based on the experimental results

a. It was observed that workability concrete decrease with increase jarosite in concrete.
b. It is observed that compressive strength of jarosite concrete increase upto 20-30% used of jarosite.
c. The tensile strength of concrete increase use of jarosite at 20-30% upto. after increase percentage of more then decrease tensile strength of concrete.
d. The rate of water absorption decrease compare with nominal mix concrete when use of jarosite 20-30% respectively.
e. It was found that capillary suction absorption value increase with increase percentage of jarosite in concrete.

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