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PERFORMANCE ON CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH SULFUR

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ABSTRACT

Having knowledge about the age of Mars "Sulfur-rich planet" has been given to a new planet. simulation-based construction material the formation of sulfuric acid and Martian dirt. Besides the accessibility of raw materials for While preserving strength, sulphur concrete may attain levels equivalent to those of typical cementation materials. Its 100 percent recyclable nature and low drying temperature make it a desired property. The characteristics of the created Martian Concrete In this investigation, various sulphur content percentages are evaluated. The ideal mixing ratios were researched. Three-point bending, unconfined compression, and splitting tests were conducted over the course of seven to twenty-eight days to ascertain strength growth, strength variability, and failure causes. The outcomes are contrasted with sulphur concrete produced with regular sand.

The ultimate strength of the combination is shown to be significantly influenced by the particle size distribution. Due to the metal-rich nature of Martian soil, high-temperature mixing also creates sulphates and perhaps polysulfates, which add to the material's great strength. The ideal mix created for Martian Concrete has an compressive strength and split tensile strength of above 50 MPa, which equates to an approximately 150 MPa concrete on Mars due to the different gravitational pull of Mars and Earth by using M_{30} grade of concrete.

Keywords: Martian soil, Sulfur concrete, compressive strength and split tensile strength.

1. INTRODUCTION

During extended periods of time, astronauts wherever feasible, use locally. Having the capacity to build living dwellings would be a highly efficient way to establish ecosystems on the planet. the surface of Mars or the moon Before doing this in-situ, it is crucial to conduct a number of preliminary research on comparable soils here on Earth in order to construct safe habitats appropriate for human existence. Analog soils for the Moon and Mars are utilised as the starting point for the discovery that concrete may be employed as a construction material.

Furthermore, heating moon dust may be risky when people are around, it's frequently harder to mould precisely, it works best in dry situations, and it's not very economical when it's wet. Ancient concrete was a marvel of engineering because of its flexibility and endurance, and this is still true today. Just take a look at some of Rome's still-standing landmarks, such the Pantheon and Colosseum. For thousands of years, concrete has shaped and advanced human civilizations. Since the time of the ancient Romans, concrete technology has evolved to meet more contemporary demands. For example, porous concrete allows hundreds of litres of water to pass across its surface without collecting, preventing puddles.

2. OBJECTIVES

The objectives of this study are as follows

a) The use of sulfur-containing cement in concrete
b) To assess the concrete's compressive and split tensile strength

3. MATERIALS

The properties of cement are presented in Table 1.

Table 1 Physical properties of cement

S. No.	Property	Cement (53 grade)
1	Specific gravity	3.136
2	Fineness	9.71%

3.1 SULFUR

The creation of sulphur concrete dates back to the. It is composed of aggregate (sand, gravel, or crushed stone) heated at temperatures higher than 115°C, which is the melting point of sulphur, and elemental sulphur. After cooling, the material reaches great strength and chemical resistance. Sulfur concrete is also thermoplastic, thus after being reheated, it is recyclable. The downside of its low melting point is that a fire might make a structure formed of it to melt down.

4. EXPERIMENTAL INVESTIGATIONS

4.1 Compressive strength results

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 2.

Table 2: Compressive strength of concrete with sulfur as partial replacement of cement in concrete

Sl.no	Sulphur Content by weight of cement	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	27.63	39.61
2	10%	30.73	44.04
3	20%	32.15	46.67
4	30%	35.32	50.68
5	40%	33.47	48.65

4.2 Split tensile strength results

The split tensile strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 3.

Table 5: Split tensile strength of concrete with sulfur

Sl.no	Sulphur Content by weight of cement	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	2.73	3.93
2	10%	3.03	4.36
3	20%	3.21	4.63
4	30%	3.37	5.02
5	40%	3.22	4.81

5. CONCLUSION

1. The compressive strength of concrete for normal concrete for 7days and 28days is 27.63N/mm^2 and 39.61N/mm^2.
2. The Split tensile strength of concrete for normal concrete for 7days and 28days is2.73 N/mm^2 and 3.93 N/mm^2.
3. The compressive strength of 30% sulphur content by weight of cement for 7days and 28days is 35.32N/mm^2 and 50.68N/mm^2.
4. The Split tensile strength of 30% sulphur content by weight of cement for 7days and 28days is 3.37 N/mm^2 and 5.02 N/mm^2.

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