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STUDY OF WATERLESS CONSTRUCTION BY USING SULPHUR CONCRETE

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Abstract

As water will be the reason for third world war due to scarcity of drinking and domestic purpose water. Preserving water is must for survival of life on earth. Being a Civil Engineer we should reduce use of water in our field by this new technique known as "Waterless Construction" by understanding the need of today. Considering this need sulphur concrete is the best option for the traditional concrete in which cement and water is used whereas in sulphur concrete there is no need of this components still it provides high strength to the structure . In which Hot - Technology with tremendous energy consumption is used which can be applied in case of construction where the scarcity of water or drought is the major problem like deserts . Also sulphur being the waste product of different industries such as oil industries , petroleum industries and sulphur mines , it can be easily available for construction and also recycling of industrial waste will take place due to this technique . In this sulphur concrete is used which is manufactured by melting the sulphur at 140-150⁰C , then adding suitable types of traditional aggregates into it and also extenders which can be ashes , quartz dust and minced chalk .This sulphur concrete mixture gives the structure waterproof , acid proof, radiation shielding properties which are essential for resisting hazardous atmospheric effects occurring now-a-days and in future due to exploitation of nature by human beings such as ozone layer depletion and increasing CO₂ concentration.

Key words : Sulphur Concrete , waterless , Hot-Technology, Sulphur

1.WATERLESS CONSTRUCTION

1.1 Introduction

Being a civil engineer our most of the work is with construction industry . This construction industry utilizes materials most extensively which results in depletion of virgin materials such as stone, river sand, water ,steel and cement material and contributing a heavy dose of CO₂ on earth .

As the whole world is facing water crisis today and still we are wasting most of the valuable water in the construction process and its different phases leading to further water scarcity .

Here , the new technology to overcome this scarcity to carry on our working process of construction. We can use the "WATERLESS CONSTRUCTION", method which practically means without water construction or dry construction which is possible up to some extent . But using less water and minimizing the water consumption by using different construction materials instead of the materials which requires large amount of water content this is the main aim of waterless construction in present days.

NEED OF WATERLESS CONSTRUCTION ;

To understand the need of waterless construction we have to study the use of water in different processes of construction such as listed below :

- I) General site activities including tool washing .
- II) Wet trades such as brickwork, screening, concreting and plastering .
- III) Ground works including grouting and drilling .
- IV) Dust separation .
- V) Lorry washing .
- VI) Testing of building plants and services .

In all of these processes water is needed and due to this need we are wasting lots of drinking and irrigation water for construction and facing the water crisis with irregular and inadequate municipal water supply .

Study and understanding the situation we are facing due to less rainfall and limited availability of reservoir water . We need this new technique of construction that is "waterless construction", which will be used for upcoming construction projects .

1.2 Methodology

In this waterless construction the Portland cement concrete is replaced by an alternative that is sulphur concrete . In which the water contents are not used ,while in Portland cement there is extensive use of water in construction process hence it may undergo some deformation .

1.3 Manufacturing of sulphur concrete

This process of manufacturing based on “ Hot –technology”, in which all the mixed components such as technical sulphur , extender , aggregates of suitable types are heated until 140-150°C . The sulphur used in the sulphur concrete production is obtained from hydro sulphurisation of gas and oil can be mixed with any type of traditional aggregates according to the proportionate ratio .Mineral aggregate is the important content in this .Extenders used such as ;

- 1)shape of volatile ashes
- 2)quartz dust
- 3)minced chalk

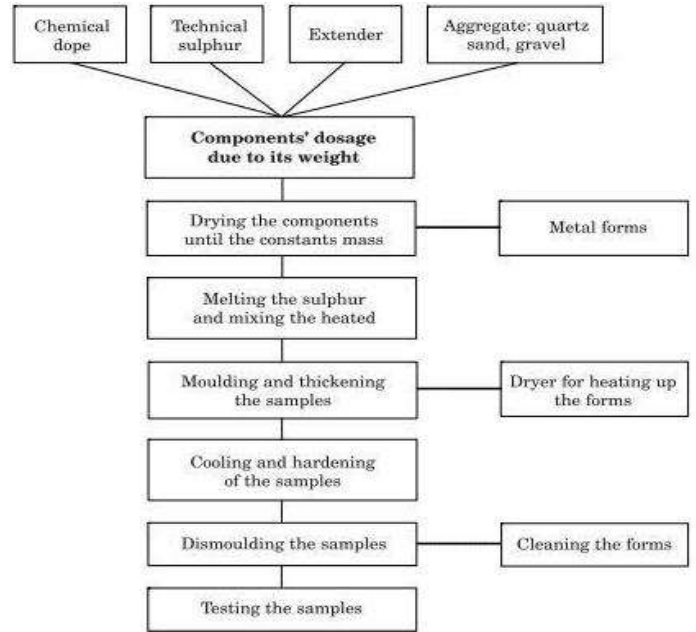


Fig-2 : Manufacturing of sulphur concrete.

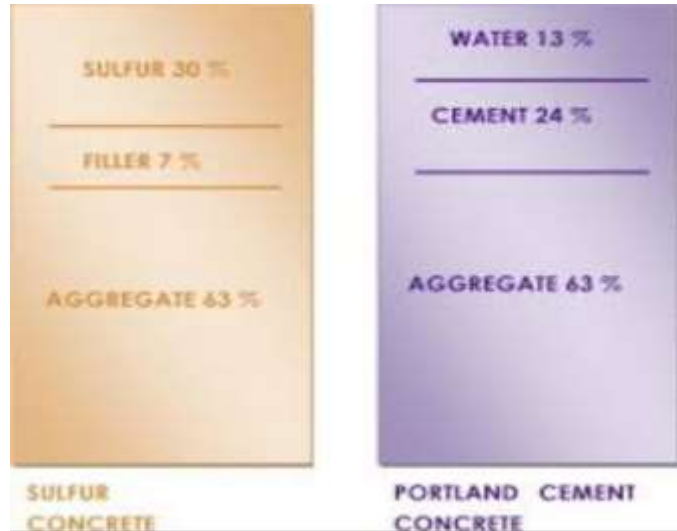


Fig-1: Components of sulphur concrete

Which reduces pores that emerge during sulphur contraction . As the sulphur change its volume due to hardening process .Excessive amount of any of the components usually leads to worsening the moulding process.

SULPHUR CONCRETE PRODUCTION STEPS :

- I) Heat up mixture until 150°C .
- II) Melting of modified sulphur and mixing the components .
- III) Moulding samples into metal moulds which were initially heated to the same temperature as mixture's suitable temperature.
- IV) Cooling the sample to ambient temperature .

2. APPLICATIONS OF WATERLESS CONSTRUCTION USING SULPHUR CONCRETE

Applications of waterless construction using sulphur concrete are as follows :

- I) Waterless construction can be used where the scarcity of water is increasing day by day .
- II) Building sidewalks and road blocks.
- III) It can also be used in less rainfall and drought facing regions .
- IV) Construction of drainage and sewage facilities .
- V) Basic coverage foundations.
- VI) Making the acid tanks .
- VII) Manufacturing and repairing concrete platforms.
- VIII) Harbour engineering .
- IX) Agriculture.
- X) Used as anti radiation protective shield .
- XI) In the desert areas where there is a less water for drinking as well as domestic purpose . we can use this technology for providing them with proper shelters without wastage of any water sources .
- XII) It can be also used in hilly or the high altitude regions because their water can' t be easily fetched out and provided from reservoirs or In normal building construction practices , for residential buildings , public buildings , road constructions or any other large ,small scale constructions where the wastage of water can occur in large extent .
- XIII) The places which are far from reservoir and we need large quantity of water for construction and its transportation cost will be

maximum so there we can use waterless construction and overcome the transportation cost.

Hence, The following table describes the difference of traditional cement concrete and sulphur concrete as per different applicable properties .

Table.1: Comparison of sulphur and cement Concrete

Cement concrete	Sulfur concrete	Unit	Properties
2200	2400	Kg/	Density
15-60	60-115	MPa	Compressive strength
6-7	10-16	MPa	Bending strength
25-28	35-50	GPa	Modulus of elasticity
0.6	0.5-1	mm/ m	Contraction
9-15	1-4	%	Porosity
Medium	High	-	Corrosive durability in aggressive surroundings
Medium	High	-	Frost resistance

3. ADVANTAGES OF WATERLESS CONSTRUCTION BY USING SULPHUR CONCRETE

Advantages of waterless construction by using sulphur concrete are as follows :

- I) It is an eco-friendly method of construction with almost no use of water content in it .
- II) It is Waterproof type of construction .
- III) Large quantity of water is going to be saved which was being to be wasted on construction sites .
- IV) The compressive strength of sulphur concrete is greater than ordinary concrete.
- V) It is a light weighted structure with constant wt. .

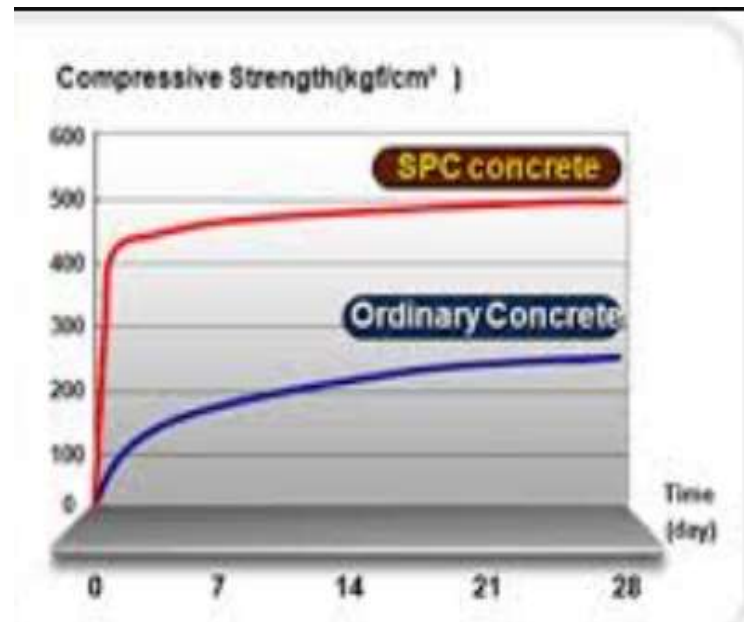
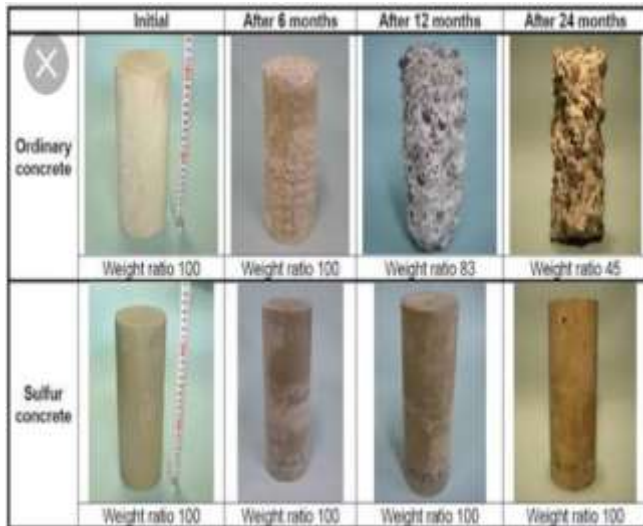


Fig-3: Compressive strength graph for concretes

- VI) It has relatively high strength and is obtained in very short time .
- VII) Resistance to most of the aggressive agents .
- VIII) It is economical up to some extent as transportation cost of water will be cut in case of hilly regions or far reservoir regions .
- IX) Ground water table will be also protected from getting depleted due to fetching of water for construction purpose through bore wells and hand pump or any source like this .
- X) As per the study the impact damage within 20 yrs . interval is found to be about 1 % only .
- XI) While using sulphur concrete the sand consumption will not be needed and the riverbeds will be saved from sand excavation which is banned now -a -days .
- XII) As carbon and hydrogen is excellent radiation shielding material , if we use it in sulphur concrete block or in our construction then it will protect us from hazardous radiations reaching on earth due to ozone layer depletion .
- XIII) It is energy saving , time saving , with better bonding strength .
- XIV) It do not create any types of cracks and thus the failure of the structures .
- XV) The weight of sulphur concrete is constant throughout whereas in ordinary concrete the weight varies.



**Fig-4: Weight variation of concrete and sulphur
Concrete**

4. DISADVANTAGES OF WATERLESS CONSTRUCTION BY USING SULPHUR CONCRETE ;

- I) Limited thermal resistance as it is thermoplastic material .
- II) A need for stable and high temperature during the production process .
- III) Also it needs tremendous amount of energy for the production of the components
- IV) As we are using sulphur in this technique the sources of sulphur will be affected due to excavation such as sulphur mines.
- V) High energy consumption during production processes.

5. CONCLUSION ;

It is an better option of traditional concrete and its mechanical and physical properties are determined more precisely, also the water is being saved which was going to be wasted in construction process of large scale or small scale projects. As it posses different protective properties such as shielding to hazardous radiations ,waterproof nature and high strength it is beneficial for all weathers in every region of our country. Also can add to the future projects of construction field considering the upcoming hazards of nature due to anthropogenic activities .

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