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Effect of Chloride on Silica Fume and Metakaoline Concrete

Prof. Ranjitsinh P. Patil[1], Prof. Ganesh S. Jadhav[2]

[1,2] Civil Engineering department,

Nanasaheb Mahadik college of Engineering, Peth (India)

ABSTRACT

In this paper, we have carried out the study of the effect of chloride (NaCl) on silica fume and Metakaoline concrete. For this study, we have used M20 grade concrete, so as to find out effect on general category concrete as it is widely used in practice. The concrete cubes (150 mm × 150 mm × 150 mm) are cast for replacement of cement by silica fume (SF) and Metakaoline (MK) with 0%, 5%, 10%, 15% and 20%. The 0% specimens are considered as 'Controlled Specimen'. Then these specimens were tested after 60, 90 and 120 days as Chloride Attack Test. For this we have kept 5% NaCl consistency. The graphs are studied with respect to 'Controlled Specimen'. These show variations in compressive strength for cement replacement by silica fume, Metakaoline concrete for chloride attack. For chloride attack, results show that up to 10% replacement of cement by SF and MK gives better compressive strength. And then compressive strength goes on decreasing subsequence. Thus 10% replacement of cement by SF and MK gives a desirable percentage of replacement.

Keywords- Admixture, Chloride attack, Silica Fume, Metakaoline, and Temperature effect.

I.INTRODUCTION

A concrete is ''durable'' if, in its environment, it has provided the desired service life, without excessive cost for maintenance and repair due to degradation or deterioration. Durability is not a property of concrete. Concrete that would be immune to the effects of freezing and thawing is of no higher ''quality'' than concrete that has no ability to resist freezing and thawing if it is to be used where it can never freeze in a critical water-saturated condition. Thus the problem faced by the engineer who prepares specifications for concrete for a particular work is to predict the deteriorating influences that could cause degradation of concrete in service in the environment at the project site over the intended service life of the concrete.

Deterioration and durability of concrete structures which are exposed to harmful ions or chemicals is subject of the major discussions for service life of high cost or key concrete structures. Sulfate attack has been reported to be a cause of damage to concrete for over a century. Many of the reinforced and unreinforced structures exposed to seawater will suffer from deleterious chemical reactions between hardened cement compositions and different sulfate ions in cementations matrix of the structures. At least six types of reactions could be described by sulfate attack. The most common reactions often used to explain the defined sulfate attack are ettringite and gypsum formation. It is generally accepted that sodium and magnesium sulfate attacks of hydrated cement matrix take place due to the reaction of sulfate ions with calcium hydroxide and calcium aluminates phases, forming gypsum and ettringite.

II. OBJECTIVES

The objectives of the proposed work are:

To study

1. Chloride attack at 5% NaCl solution on silica fume concrete and Metakaoline concrete.
2. The comparative study of behavior and compressive strength of silica fume concrete and Metakaoline concrete.

III.METHODOLOGY

1. The preparation of M_{20} grade concrete.
2. The replacement of cement with 0%, 5%, 10%, 15% and 20% with silica fume and Metakaoline.
3. The casting of concrete cube with size of 150 mm X 150 mm X150 mm with 0%, 5%, 10%, 15% and 20% replacement of cement with silica fume and Metakaoline.
4. Then taking test chloride attack on concrete for a period 60, 90 and 120 days.
5. For chloride test concrete cube kept in 5% Nacl solution for a period of 60, 90 and 120 days.
6. Testing concrete cube in the laboratory by using compression testing machine (CTM) of capacity 2000KN.

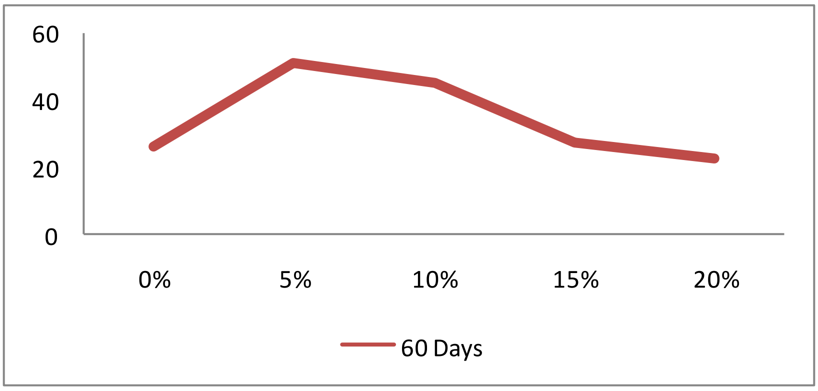
IV. FINAL MIX-PROPORTION

Cement (kg/m^3)	**Water** (kg/m^3)	**Sand (fine aggregate)** (kg/m^3)	**Coarse aggregate** (kg/m^3)
372	190.87	567.05	1248.21

V.COMPRESSIVE STRENGTH OF CONCRETE

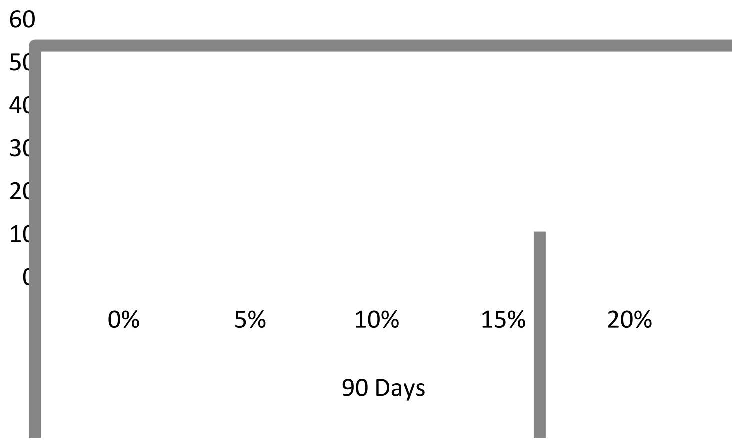
5.1 For 60 days Chloride attack

Sr. No.	**% of Replacement of Cement by SF & MK**	**Average Compressive Strength in N/mm^2**
1	0	**26.23**
2	5	**51.11**
3	10	**45.1**
4	15	**27.11**
5	20	**22.51**



5.2 For 90 days Chloride attack

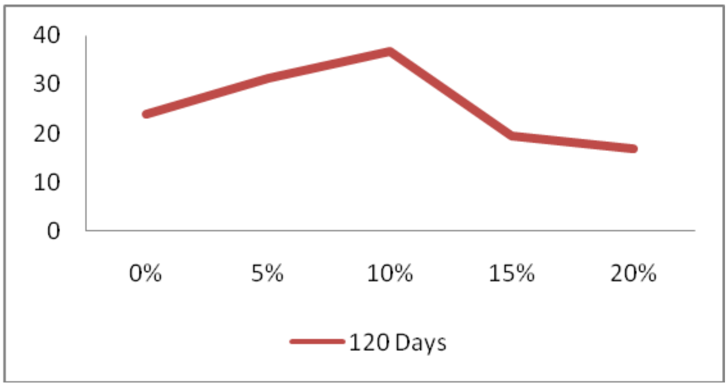
Sr. No.	% of Replacement of Cement by SF & MK	Average Compressive Strength in N/mm^2
1	0	**25.35**
2	5	**49.70**
3	10	**39.38**
4	15	**27.76**
5	20	**24.85**



5.3 For 120 days Chloride attack

Sr. No.	% of Replacement of Cement by SF & MK	Average Compressive Strength in N/mm^2
1	0	**23.84**
2	5	**31.30**
3	10	**36.77**
4	15	**19.42**

5	20	**16.78**



VI.CONCLUSIONS

From the experimental study it is concluded that,

1. For the 5% chloride attack, it is clearly seen that for the replacement of cement by SF & MK, the compressive strength of concrete goes on decreasing.
2. For the chloride attack, 5% & 10% replacement of cement by SF and MK the compressive strength is 50% greater than that of 15% & 20% replacement.
3. For the chloride attack 5% and 10% replacement concrete behaves more strong as compared to 15% and 20% replacement concrete.
4. The 5% and 10% replacement of cement by SF and MK gives beneficial replacement.

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