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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
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To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

بعض الوثائـــــــق الاصليـــــة تالفـــة

بالرسالة صفحات لم ترد بالاصل

٤٧١٠

EFFECT OF SOME CONCRETE ADMIXTURES ON THE SILICA FUME BLENDED CEMENT PASTES

A Thesis
Presented to

Faculty of Science
Zagazig University

By

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For

The Degree of Doctor of Philosophy
In
Science, Chemistry

1996

EFFECT OF SOME CONCRETE ADMIXTURES ON THE SILICA FUME BLENDED CEMENT PASTES

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ACKNOWLEDGEMENT

I am deeply thankful to God, by the grace of whom the progress and success of this work was possible.

The author is deeply indebted to Prof. Dr. ***Hamdy El-Didamony****, Prof. of Inorganic Chemistry, Faculty of Science, Zagazig University, for suggesting the problem, critical continuous supervision, fruitful discussions and encouragement.*

The author wishes to express his deepest gratitude to Prof. Dr. ***Mohamed Gamal Helmy Abd El-Wahed****, Prof. of Physical Chemistry, Faculty of Science, Zagazig University, for his continuous encouragement and kind help throughout this work.*

The author wishes also to express his sincere thanks to Dr. ***Ahmed Abd El-Moneim Amer****, Lecturer of Inorganic Chemistry, Faculty of Science, Zagazig University, for his interest in work and his valuable discussions.*

Finally, I wished to thanks Prof. Dr. ***Abd El-Azziz Sharaf*** *and all staff member in the Institute of Efficient Productivity for many facilities they offered.*

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CHAPTER I

CHAPTER 1
1. INTRODUCTION

1.1. Introductory Notes:

Admixtures for concrete are defined as materials other than hydraulic cement, water, or aggregates that are added immediately before or during mixing. Admixtures are added to modify the properties of fresh or hardened concrete in such a way as to make it more suitable or economical for the job at hand.

Admixtures can be classified into the following categories: chemical, mineral, air-entraining, and miscellaneous admixtures (used for special purposes such as grouting, coloring, flocculating, damp proofing, corrosion inhibition, .. etc.).

Chemical admixtures are classified into: water reducers / retarders, superplasticizers and accelerators[1].

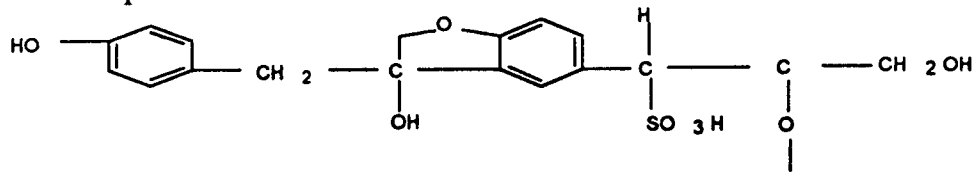
1.2. Water Reducers/Retarders:

A water reducer can be defined as an admixture that reduces the amount of mixing water of concrete for a given workability. It improves the properties of hardened concrete, and in particular, increases strength and durability. The reduction of mixing water must be at least 5%. However, the commercial water reducers can reduce mixing water up to 10-15%.

There is another mode of the use of these admixtures, involving reduction of both water and cement, so that, workability and strength of concrete containing admixtures are similar to the control concrete. Besides allowing cement saving, these admixtures are capable of reducing the heat of hydration, a property that is useful for concerning in hot climates or massive structures.

If water reducer is added without modifying mix properties, concrete workability improves, in this case acts as plasticizer. This is particularly useful for placing concrete in areas of high steel contents that require a more workable concrete.

There are many types of water reducers or retarders. These are water soluble organic compounds. The main compounds used in the manufacture of water reducers can be divided into four groups. The first one contains Ca, Na or NH_4 salts of lignosulphonic acids. The second group contains the hydroxy carboxylic acid generally as Na, NH_4 or triethanolamine salts. The carbohydrates belong to the third group. All the water reducing admixtures are generally offered by supplier as an aqueous solution with a specific gravity in the range of 1.10 to 1.30 g/ml. The lignosulphonate molecule may be have an average molecular weight of approximately 20000 to 30000 with the molecular weight distribution varying form a few hundreds to 100000[2,3]. The lignosulphonate molecule is very complex and may be visualized as a polymer of a substituted-propane unit with hydroxyl (-OH), methoxy ($-OCH_3$), phenyl ring (C_6H_5-) and sulphonic acid ($-SO_3H$) group. Lignosulphonate is obtained as a waste liquor during the process for the production of paper-making pulp from wood whose composition includes about 20-30% of lignin. It contains a complex mixture of sulphonation products of lignin, decomposition products of cellulose and lignin, various carbohydrate and free sulphuorous acid and sulphates.



Structural unit of lignosulphonate molecule

In the lignosulphonate salts used as admixtures, a metal or ammonium cation replaces hydrogen in the sulphonic group. Calcium or

sodium salts are the most widely used cations in water reducer formulation. Calcium lignosulphonate is however, cheaper than sodium lignosulphonate.

The effect of lignosulphonate on the Portland cement hydration is very complex as the cement components can affect each other during hydration. Thus, the influence of the admixture on cement hydration depends on the composition and in particular on C_3A, alkali and sulphate content. Other parameters are surface areas, lignosulphonate composition, molecular weight, sugar content, dosage of the admixture, and mixing procedure[4].

Addition of sodium lignosulphonate results a very early acceleration of C_3A hydration, according to equation:

$$C_3A + 3CaSO_4 + 26H_2O \rightarrow C_3A.\ 3CaSO_4.\ 32H_2O.$$

because of the absence of $Ca(OH)_2$ in solution[5]. Lignosulphonate inhibits the release of $Ca(OH)_2$ from C_3S hydration and, at the same time, the highly alkaline solution reduces the solubility of any $Ca(OH)_2$ present. Calcium lignosulphonate containing sugars accelerates the C_3A hydration and inhibits the C_3S hydration during the first 2-3 hours[6]. Assuming C_4AF behaves similar to C_3A and that the β-C_2S hydration is negligible during the first few hours, it could be concluded that the addition of lignosulphonate may accelerate the initial set of Portland cement with high aluminate/C_3S ratio, and may retard the initial set of cements with low aluminate phase/C_3S ratios.

The effect of sodium lignosulphonate superplasticizer on the hydration of Portland cement type V have been investigated by XRD and FTIR Techniques[7]. The results of these studies indicate that the superplasticizer inhibits the hydration reaction as demonstrated by the reduction of the formation of $Ca(OH)_2$ as well as lower degree of polymerization of silicate anions.