AIN SHAMS UNIVERSITY
FACULTY OF SCIENCE
Chemistry Department

Studying the Effect of Using Some Chemical Compounds Taken from Cellulose, Protein and Fat Waste as Concrete Admixtures

A Thesis

Submitted in Fulfillment for the Requirements
of the Ph.D. in chemistry

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STATEMENT

This dissertation is submitted to Ain Shams University for the philosophy doctor degree of Science in Chemistry.

The work included in this thesis was carried out by the author at the Chemistry Department, Faculty of Engineering, Ain Shams University.

No part of this thesis has been submitted for a degree or qualification at other university or institution.

Date **:** / / 2005
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List of symbols

Symbols

ACI	American Concrete Institute
Conc.	Concentration
C.S.	Compressive Strength
C_3A	Tricalcium Aluminate
C_3S	Tricalcium Silicate
C_2S	Dicalcium Silicate
DBS	Dodecyl Benzene Sulphonate
HRWR	High Range Water Reducers
LA	Lauric Acid
LMC	Latex Modified Concrete
MA	Myristic Acid
MFSR	Melamine Formaldehyde Sulphonate Resin
NFSR	Naphthalene Formaldehyde Sulphonate Resin
OA	Oleic Acid
PSI	Pounds Per Square Inch
P.V.C.	Poly Vinyl Chloride
SA	Stearic Acid
SO	Sunflower Oil
STP	Standard Temperature and Pressure
T	Time (days)
W/C	Water/Cement Ratio by Weight
WRA	Water Reducing Agent

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Philosophy Doctor Degree of Science in Chemistry, 2005

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Summary

The use of chemical admixtures in concrete has grown considerably specially in the last decade, so that the amount of concrete which contains admixtures has increased. This has led to a better understanding of the researches done on the properties of admixtures by the concrete engineer and chemist.

The increase in the use of admixtures has been reflected in a greater interest in admixture materials and technology from all sectors of the industry.

The objective of this research is studying the effect of using different types of organic wastes (cellulose, fat and protein wastes) after making some chemical modifications to these wastes, and investigating their effects as chemical admixtures for concrete with regarding to the economic aspects of these admixtures.

In order to understand more fully the effect that these admixtures have on the properties of fresh and hardened concrete, and to gain an insight into the mechanism of action of these admixtures, it is useful to make a detailed review of the used chemical materials, types of

admixtures, and also the previous experimental and theoretical studies related to our research interest.

In this investigation, an experimental program is designed to study the effect of the prepared admixtures taken from cellulose, protein and fat wastes on the properties of concrete mixes. And to achieve this objective, **the experimental program consists of four stages:**

Stage 1:

This stage was carried out to demonstrate the effect of using cellulose waste (mainly from starch), sodium silicate, urea, calcium acetate, calcium formate, animal glue (protein waste) and urea formaldehyde polymer on the properties of fresh (slump test, setting time and air content%) and hardened concrete (compressive strength).

Stage 2

This stage aims to study the effect of using the air-entraining admixtures such as sodium stearate (from fat waste), sodium dodecyl benzene sulphonate in addition to sodium dodecyl benzene sulphonate formaldehyde condensate on the properties of fresh and hardened concrete.

Stage 3

This stage was done to investigate the effect of treatment of cellulose waste (mainly from starch) by the selected admixtures (sodium silicate, urea, calcium formate) on the physical and mechanical properties of fresh and hardened concrete mixes.

Stage 4

The final stage concerned with the improvement of the mechanical properties (compressive strength) of the air-entrained concrete mixes by mixing the optimum dose for each of the air-entraining admixtures studied in stage 2 with the optimum dose of chemically treated cellulose waste, animal glue and urea-formaldehyde polymer.

From the analysis and discussion of the test results obtained in this research, it can be shown that the properties of fresh and hardened concrete using these admixtures are being affected especially the improvement of the mechanical properties (compressive strength).

The study plan includes:

-- Introduction
-- Literature review
-- Properties of materials
-- Program and test of research work
-- Experimental investigation
-- Summary, conclusions and recommendations

Key words:

Chemical admixtures, Organic wastes, Water reducing agents, air-entraining agents, Cellulose derivatives, Setting time, Air content, Slump test, Compressive strength.

Aim of Work

The aim of this research is to study the effect of using different types of organic wastes such as cellulose, fat and protein wastes (after making some chemical modifications on them) as chemical admixtures for concrete with respect to the economic aspects of these admixtures.

Organic wastes came from paper, textile and food industries are one of the major environmental problems which tax the ingenuity of both chemist and environmental engineer, and in order to contribute in environmental protection, trials are made on these wastes after chemical treatment as concrete admixtures, these treatments will be carried out by using chemical materials such as sodium silicate, urea and urea-calcium formate mix.

This work was carried out through studying the effect of different types of chemical materials (starch as cellulose waste, sodium silicate, calcium acetate, urea, calcium formate, animal glue as protein waste and urea formaldehyde polymer) as water reducers and (sodium dodecyl benzene sulphonate, sodium dodecyl benzene sulphonate formaldehyde condensate and sodium stearate as fat waste) as air entraining agents on the