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IMPROVING THE CONCRETE CHARACTERISTICS EXPOSED TO CHLORIDES IN COASTAL ZONES

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ABSTRACT

Due to the significance of acquiring concrete structures with longer life span in coastal zones, this research was commenced with the objective of improving the concrete characteristics when exposed to sodium chloride in coastal zones. Previous literature in the field of concrete in coastal zones was revised. Additives to improve the concrete characteristics (i. iron fillings, sika and fiber) were proposed. An experimental procedure was designed, where 12 beams were cast with traditional concrete and with concrete with one of the additives and immersed in 40,000 ppm salty water for 1,12 and 18 months. Investigations and measurements will be carried out to define their characteristics. Measurements were undertaken and results were discussed. Finally, conclusions were provided and recommendations were advocated.

KEYWORDS: Improving Concrete Characteristics, Investigations and Measurements

INTRODUCTION

Chloride attack affects structures in marine environment. The chloride attack forms corrosion product leading to the appearance of cracks, consequently cracking and catastrophic structural failure occurs. Corrosion takes place as the chloride ions meet with the steel to produce a chemical process, which forms hydrochloric acid.

RESEARCH OBJECTIVE

Due to the significance of acquiring concrete structures with longer life span in coastal zones, this research was commenced with the main objective of improving the concrete characteristics when exposed to sodium chloride in coastal zones. The subsequent research objectives were to propose additives (i. iron fillings, sika and fiber) to enhance the characteristics of concrete subjected to Chlorides; cast12beams with traditional concrete or with different additives and examine their response in order to determine the efficiency of each additive to choose the most efficient.

RESEARCH METHODOLOGY

Accustomed to the defined objectives, the research study phases *(i. methodology)* were designed. ***Phase* (1)** will review the previous literature. ***Phase (2)*** will propose additives (i. iron fillings, sika and fiber). 12beams will be cast with traditional concrete or with different additives and immersed in 40,000 ppm salty water for 1, 12 and 18 months. Investigations and measurements will be carried out to define their characteristics. ***Phase (3)*** analyzes the measurements and establishes relationships. Results will be discussed and the most efficient additive will be selected. ***Phase (4)*** will deduce conclusions and provide recommendations to the engineering practice.

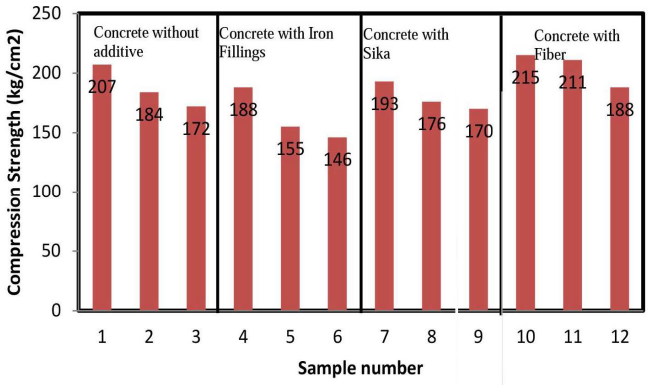

Figure 1: Cube Strength at 40000 ppm for Concrete Cast with and without Additive

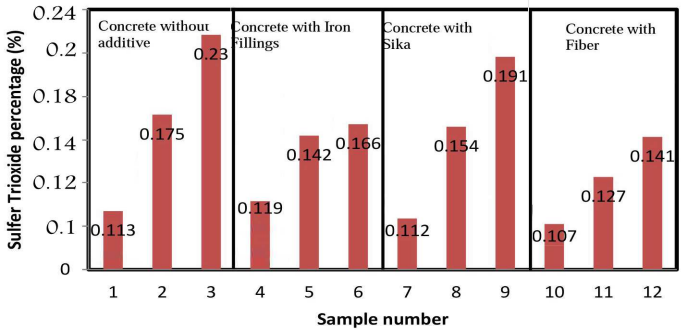

Figure 2: Sulfur Trioxide Percentage at, 40000 ppm for Concrete Cast with and without Additive

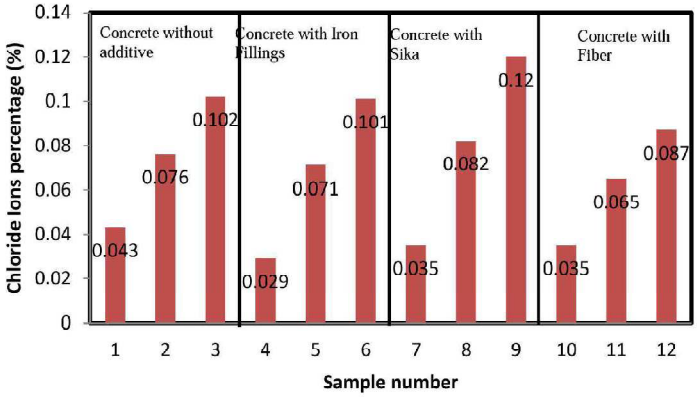

Figure 3: Chloride Ion (Cl-) % at 40000 ppm for Concrete cast with and without Additive

EXPERIMENTAL WORK

An experimental scheme was designed; table (1), and the experimental work was carried in the Properties of Materials in Ain Shams University Laboratory.12 beams were cast (i. 3 were cast with traditional concrete, 3 with iron fillings additive, 3 with Sika and 3 with plastic fiber sheets). The beams were immersed in tanks of 40,000 ppm salty water. The beams were removed after 1or 12 or 18 months, where core specimens were extracted and tested to evaluate their characteristics.

Table 1: The Experimental Program and the Percentage of Enhancement of Concrete Characteristics

Specimen No.	Concrete Mix	Sodium Chloride (ppm)	Age (month)	Comp. %	So3 %	Cl %
1	Traditional	40,000	1	0	0	0
2			12			
3			18			
4	Iron Fillings	40,000	1	-15.11	-27.83	-0.98
5			12			
6			18			
7	Sika	40,000	1	-1.16	-16.96	17.65
8			12			
9			18			
10	Fiber	40,000	1	9.3	-38.7	14.7
11			12			
12			18			

RESULTS ANALYSIS AND DISCUSSIONS

The results were presented on graphs to relate the different variables to the concrete characteristics; figures (1) to (3). The percentage of concrete enhancement was calculated. A summary of percentages of decrease or increase, relative to the traditional concrete, is listed on table (1).

CONCLUSIONS AND RECOMMENDATIONS

The Following Conclusions were Deduced

- Fiber sheets provide the highest performance at higher saline concentrations, in terms of Compression strength and sulfer trioxide So3%.
- Fiber did not provide a markedly effect, in terms of Chloride ions (Cl-) %.

It is thus suggested to make the decision upon the in hand condition.

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