Ain Shams University **Faculty of Science**

Protection of Concrete and Steel Reinforcement from Deterioration under the Effect of Corrosive Marine Environment

A Thesis submitted for

The Award of the Ph.D. Degree of Science in Chemistry

By

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To

Chemistry Department

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Acknowledgement

I am deeply thankful to ALLAH, lord of the world for showing me the right path and helping me to complete this work by the grace of whom.

I wish to express my indebtedness and deepest sincere gratitude and appreciation to ***Prof. Dr. Hamdy Abd El-Aziz El-Sayed Abu-Zeida****, Prof. of Chemistry and Technology of Building Materials, Housing and Building National Research Center, Cairo, for his supervision, suggesting the research problem, useful guidance, fruitful discussion, criticism, encouragement, kindness and facilities he offered me throughout the progress of this work.*

Deep thanks to ***Prof. Dr. Ayman Ahmed Abd El-Aziz El-Dakhakhny*** *Prof. of Inorganic Chemistry, Faculty of Science, Ain Shams University, for his supervision, encouragement and facilities he offered me throughout the progress of this work.*

I am also gratefully thanks ***Prof. Dr. Ayman Mohamed Ebraheem Kandeel, Prof****. of Chemistry and Technology of Building Materials, Housing and Building National Research Center, Cairo, for his supervision, encouragement and facilities he offered me throughout the progress of this work.*

My Deep gratitude and thanks to ***Dr. Mahmoud Ahmed Ismail Gharieb*** *Dr. of Chemistry and Technology of Building Materials, Housing and Building National Research Center, Cairo, for his supervision, his contribution in practical section, revision the final results, also help me for finishing thesis in the final form, encouragement, fruitful discussion and facilities she offered me throughout the progress of this work.*

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Abstract:

Reinforced concrete structures located in marine environment are likely, within a short span of time, exhibit signs of distress due to the ingress of salts and their attack on concrete and the embedded steel reinforcement leading to unsightliness, concrete cracking and structural weakness.

The process of the destruction under the attack of sea water is composed of a large number of separate, but more or less simultaneous reactions. Sea water contains chlorides as well as sulfates bound in addition to alkalies, also, to magnesium and beyond this, water absorbs CO_2. Therefore, the structures will be subjected concurrently to sulfate attack and chloride – induced corrosion of the steel reinforcement.

Therefore, the main goal of the current study is to propose and investigate concrete ingredients as well as protective measures that are capable of:

- Hindering the transportation of these inimical elements through concrete.
- Protecting concrete form sulfate and chloride attack and their harmful effects.
- Protecting the embedded steel reinforcement from corrosion.

In the current study, confronting the concomitant effect of sulfate and chloride on concrete will be investigated as follows:

Type V (Sulfate – resisting cement - SRC) will be used. That cement will be blended with specific chloride binder (chloride – scavenger) for fixing chloride as an insoluble

reaction product. In addition the current study will investigate the steel reinforcement protection by producing an innovative priming coat of Portland cement slurry over the reinforcement. Such coat will incorporate a specific corrosion inhibitor. The study will investigate, also, the effect of this coating procedure on the concrete- steel bond as well as the mechanisms involved.

Hopefully, the results of the current study will present a potentially efficient solution for preventing damage of structures at areas that constitute nowadays the most intense areas of major construction in Egypt i.e. the Northern and Eastern marine as well as Suez canal provinces.

Aim of work

In the current work, a novel route for confronting the concomitant effect of sulfate and chloride, therefore: Type V (SRC) cement will be used for preparing concrete, That cement will be blended with a chloride – binder (chloride – scavenger) for fixing chloride into an insoluble reaction product.

As to the steel reinforcement, the current study will investigate steel protection by an innovative coating in which a priming coat of portland cement slurry incorporating

A specific corrosion inhibitor will be applied over the steel surface.

Consequently, the current study will present modified concrete ingredients as well as novel steel Protective measures that, hopefully will be capable of :

- Protecting concrete in (marine areas) from invading sulfates and chlorides and their inimical effects.

  Protecting the embedded steel reinforcement form corrosion.

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