VIET NAM NATIONAL UNIVERSITY
HO CHI MINH CITY
UNIVERSITY OF TECHNOLOGY

SOCIALIST REPUBLIC OF VIETNAM
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THESIS INFORMATION

Thesis title:	**STUDY ON EFFECTS OF SOME ADDITIVES TO INHIBIT CORROSION OF CONCRETE REINFORCING STEEL IN TROPICAL MARINE ENVIRONMENT**
Major:	**ELECTROCHEMICAL TECHNOLOGY AND METAL PROTECTION**
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1. Abstract

Corrosion of steel reinforced concrete is a serious problem that obstructs their wider applications in adverse environments, especially under seawater or in tropical marine atmosphere along coastal regions of Vietnam. To suppress the corrosion of steel reinforced concrete, many corrosion inhibitor additives have been studied and applied. This thesis reports the results of research on various potential additives, such as sodium silicate, urea, thiourea, sodium nitrite, calcium nitrate, and silica fume. The inhibitor effect on corrosion of reinforcement in the concrete was studied in stimulated environment by using solutions extracted from the seawater/cement mixture. Moreover, the field investigation of the inhibition effect was carried out by immersing steel reinforced concretes under seawater and exposing them to the marine atmosphere of Nha Trang. The degree of steel corrosion in concrete based on additives were analyzed and evaluated through mechanical testing and electrochemical measurements of the samples. The experimental results indicated that there is a remarkable difference in

inhibition efficiency of each inhibitor in optimal concentration on steel reinforced concrete under the survey conditions. From a theoretical perspective, the mechanism of corrosion when adding these inhibitors is also mentioned and discussed.

2. New contributions of the thesis

The thesis research found that:

- The inhibition efficiency (Z) on steel corrosion of sodium silicate, urea, and thiourea in the solutions extracted from the mixture of "seawater - cement" increased in the following order: Z (sodium silicate) < Z (urea) < Z (thiourea).
- Results obtained by electrochemical measurements reveal that the sodium silicate, urea and thiourea are considered mixed type inhibitors, but which mainly adsorb on anode of steel surface, protecting it by the blocking effect.
- The corrosion rate of reinforced concrete submerged in seawater decreases with increasing silica fume concentration from 0 – 10% by weight of cement. That can be explained by silica fume increased greatly tightness and density of concrete, reducing the diffusion process of water and chloride ions (Cl^-) into the concrete.
- In the coastal atmosphere in Nha Trang (12 months), the inhibition efficiency (Z) for steel reinforcement in concrete gradually increases in the following order: Z (thiourea) < Z (urea) < Z (sodium silicate) < Z (silica fume).
- In the case of the submerged seawater zone in Nha Trang (36 months), the inhibition efficiency (Z) of sodium silicate, urea, thiourea (from 0.05 to 0.20 wt%), and silica fume (replacing cement from 2.5 to 10 wt%) for steel reinforcement increases in the following order: Z (thiourea) < Z (urea) < Z (silica fume) < Z (sodium silicate).
- The reinforcement corrosion rate in concrete of all test specimens submerged in seawater at the depth of 0.5 m is higher than the depth of 1.0 m.

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