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Calcium Hydroxide as an Alkaline Solution for Electrochemical Chloride Extraction (EGE) Method

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Abstract

Corrosion of steel reinforcement due to ingress of chloride ions (Cl^-) causes the deterioration of RC structures. Reduction of Cl^- from steel reinforcements prevent the corrosion. Cathodic Protection (CP) method removes Cl^- from embedded steel reinforcement in RC structures. Electrochemical Chloride Extraction (ECE) method is an extend of CP, which accelerate the Cl^- removal by covering anode using chemical media. The objectives of this study are to introduce new chemical media for the ECE and to compare the performances of ECE over CP.

Five RC beams were cast using cage consisted of 16 mm diameter steel reinforcements, embedded in Grade 20 concrete. After 28 day of curing, corrosion of four RC beams was accelerated by performing Accelerated Corrosion Test Method (ACTM) until that 0.2 mm wide corrosion crack was appeared. Free and total Cl^- concentration and rust formation for remained beam and one out of four corroded beams, were measured to identify the effect of ACTM. Two of the remained three beams, were subjected to CP and ECE while other corroded beam was used as control beam. Copper meshes were used as anode for CP and ECE and copper mesh of one beam was covered by 5 mm thick hydrated calcium hydroxide layer as the proposed chemical media for ECE. Current was supplied for two RC beams with constant voltage of 11.5 V and conducted until current reduces below 0.1 A. All the three RC beams were subjected to free and total Cl^- ion and rust formation measurements to identify the effect of calcium hydroxide. The CP and ECE remove around 49% and 69% of total Cl^-, respectively. These methods prevent further corrosion of RC structures by removing Cl^- near the steel reinforcements and producing alkaline conditions around the steel bars which helps to form iron oxide film around the steel bars. With ECE, calcium hydroxide helps to increase the efficiency of the CP by nearly 20% with removing the Cl^- approached towards copper mesh area.

Keywords: *calcium hydroxide, chloride ion, corrosion, electrochemical*

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