

DESIGN OF IMPRESSED CURRENT CATHODIC PROTECTION FOR
STEEL IMMERSED IN FRESHWATER

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DEDICATION

To my beloved parents, siblings and friends for their endless loves and supports...

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ABSTRACT

Impressed current cathodic protection (ICCP) and coating give the optimum protection against corrosion for steel immersed in freshwater. This project presents the results of a study on the effectiveness of coating, impressed current cathodic protection and different environment conditions in preventing corrosion of steel. Experimental tests were carried out on coated and bare steel plates with ICCP and without ICCP by immersing in stagnant and flowing freshwater for one month. The results demonstrated that for coated and bare steel with ICCP and different variable resistance, the values of the potential are sufficient to protect the bare and the coated steel -840mV to -875mV . For coated steel without ICCP immersed in stagnant freshwater the potential has changed from -702 mV to -630mV , but for the bare sample the change in potential was about -10mV this may be due to oxide layer formed on the metal surface. For coated steel without ICCP immersed in flowing freshwater the drop in potential was about -50mV and the bare steel with the same condition was about -100 mV . A good agreement was observed for corrosion rate between weight loss measurement (4.29 mpy) test and electrochemical test (4.27 mpy) for bare steel in stagnant freshwater. The location of the reference electrode has significant implications for the control the potential change of ICCP system, the corrosion potential increases at the top of the sample (60cm below the water) and decrease when the sample was immersed further down to 1 meter in the water level.

ABSTRAK

Salutan dan perlindungan katod arus bekasan (ICCP) dapat memberikan perlindungan yang optimum pada keluli apabila direndam di dalam air bersih. Projek ini bertujuan untuk mengkaji kesan salutan dan perlindungan katod arus bekasan dan keadaan persekitaran yang berbeza pada kakisan keluli. Kajian dijalankan selama sebulan di dalam air genang dan air yang mengalir dengan menggunakan dua jenis keluli iaitu keluli bersalut dan tanpa salutan. Ia dibahagikan kepada dua bahagian iaitu dilengkapi sistem ICCP dan tanpa sistem ICCP. Keputusan kajian menunjukkan nilai upaya pada keluli tanpa salutan dan keluli bersalut yang dilengkapi sistem ICCP adalah mencukupi untuk melindungi keluli- keluli tersebut (-840mV hingga -875mV). Manakala keputusan nilai upaya pada keluli bersalut tanpa sistem ICCP yang direndam di dalam air genang berubah dari -702 mV kepada -630mV. Berlainan pada keluli tanpa salutan iaitu hanya -10mV disebabkan kehadiran lapisan oksida. Keputusan nilai upaya untuk keluli bersalut tanpa dilengkapi sistem ICCP di dalam air mengalir adalah -50mV, manakala bagi keluli salutan adalah -100 mV. Keputusan ujian kehilangan berat dan juga ujian elektrokimia tidak memberikan perbezaan yang ketara nilai kadar kakisan pada keluli tanpa salutan di dalam air genang iaitu (4.29) mpy untuk ujian kehilangan berat dan (4.27) mpy untuk ujian elektrokimia. Kedudukan elektrod rujukan juga memberikan kesan pada nilai upaya di dalam sistem ICCP ini. Nilai upaya kakisan meningkat apabila kedudukan elektrod rujukan berada di atas sampel (60sm dari paras air) dan menurun apabila diletakkan di bahagian bawah air iaitu (1 meter dari paras air)