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CORROSION BEHAVIOUR OF ZINC IN SIMULATED CONCRETE PORE
SOLUTION

By
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PENGAKUAN DAN PENGESAHAN LAPORAN PITA I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:.....
CORROSION BEHAVIOUR OF ZINC IN SIMULATED CONCRETE PORE SOLUTION

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telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Fizik sebagai memenuhi sebahagian daripada keperluan memperoleh Ijazah *SM. SA. Gunaan (Fiz. Elek & Inst)*, Fakulti Sains dan Teknologi, UMT.

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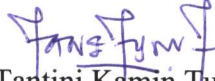
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DECLARATION

I hereby declare that this thesis entitled Corrosion Behaviour of Zinc in Simulated Concrete Pore Solution is the result of my own research except as cited in the references.

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ABSTRACT

The corrosion behaviour of zinc samples has been studied in simulated concrete pore solution (saturated $\text{Ca}(\text{OH})_2$ solution) that contained 50% calcium hydroxide, $\text{Ca}(\text{OH})_2$ and 50% seawater (NaCl) for beaker 1. Whereas in beaker 2, the solution used was 50% calcium hydroxide, $\text{Ca}(\text{OH})_2$ and 50% distilled water (H_2O). These experiments were done at room temperature condition. The beneficial aspects of zinc samples were revealed from the experiments conducted. Weight loss of zinc samples as well as their surface morphology in the presence of calcium hydroxide, $\text{Ca}(\text{OH})_2$, seawater (NaCl), and distilled water (H_2O) were investigated. Weight loss experiment involving immersion of the samples in the solution provided was conducted for 49 days or equivalent to 7 weeks. The effects of dissolved oxygen in environmental condition on all samples in both solutions were also investigated. The corrosion products and the microstructure on the zinc samples were characterized using Scanning Electron Microscope and Energy-Dispersed X-ray Spectroscopy (SEM-EDS). The plots of graphs obtained showed that the weight losses of both samples in both beaker increases with the immersion of time. The results showed that the samples in beaker 1 have higher value of weight loss with the same duration of immersion time as compared to that of samples in beaker 2. The presence of more oxygen in beaker 1 with the usage of seawater (NaCl) with the presence of organisms contributes to the dissolution of zinc, hence increasing the weight loss. The corrosion rates in both solutions and both beakers decreased with the increasing of time due to the contamination of the seawater environment by corrosion deposits that weakened the water and at the same time reduced the chemical reactivity that supposed to occur. Corrosion process in deep seawaters occurs under much specified conditions and is characterized mainly by high chloride contents, the presence of CO_2 and H_2S and also micro organism. In the micrographs, flakes are clearly seen which prove the presence of corrosion products like metal hydroxides and its oxides. From the analysis, it shows that the ferum (corrosion) exists in beaker 2 is less compared to beaker 1. The existence of micro organisms from the usage of seawater as part of solution in beaker 1 contributes to the corrosion developments in beaker 1.

ABSTRAK

Sifat kakisan bagi sampel bahan zink telah dikaji di dalam larutan yang menyerupai larutan konkrit (larutan kalsium hidroksida, Ca(OH)_2 yang mengandungi 50% kalsium hidroksida, dan 50% air laut (NaCl) bagi bikar 1. Manakala, dalam bikar 2, larutan yang digunakan ialah 50% kalsium hidroksida dan 50% lagi air suling (H_2O). Eksperimen ini dijalankan pada suhu bilik. Aspek kepentingan sampel zink dapat diketahui melalui eksperimen ini. Kehilangan berat serta keadaan morfologi permukaannya dengan kehadiran kalsium hidroksida, Ca(OH)_2 , air laut (NaCl), dan air suling (H_2O) telah dikaji. Eksperimen kehilangan berat yang melibatkan rendaman sampel-sampel tersebut ke dalam larutan yang telah disediakan dijalankan selama 49 hari atau bersamaan dengan 7 minggu. Kesan oksigen terlarut di dalam keadaan persekitaran terhadap semua sampel bagi kedua-dua larutan yang disediakan turut dikaji. Hasil-hasil kakisan dan mikrostruktur di atas sampel-sampel zink tersebut telah dicirikan menggunakan Mikroskopi Pengimbasan Elektron dan Spektroskopi Serakan Tenaga Sinar-X (SEM-EDS). Graf-graf yang diperolehi dalam kajian ini menunjukkan kehilangan berat bagi semua sampel untuk kedua-dua larutan meningkat apabila tempoh rendaman bertambah. Adalah didapati juga bahawa, keputusan juga menunjukkan bahawa bikar 1 menunjukkan nilai kehilangan berat yang lebih tinggi berbanding dengan bikar 2. Kehadiran lebih banyak oksigen dalam bikar 1 dengan penggunaan air laut (NaCl), ditambah dengan kehadiran mikroorganisma menyumbang kepada *dissolution of zincs*, lalu menyebabkan peningkatan kehilangan berat. Kadar kakisan bagi kedua-dua larutan yang digunakan dalam kedua-dua bikar menurun dengan kadar masa rendaman disebabkan oleh pencemaran air laut dengan bahan-bahan kakisan yang mengakibatkan ikatan kimia dalam air itu menjadi lemah dan pada waktu yang sama mengurangkan aktiviti kimia yang sepatutnya berlaku. Proses kakisan dalam air laut berlaku di bawah keadaan yang spesifik dan dikriteriakan khususnya dengan kehadiran klorida, kalium oksida, CO_2 and H_2S serta mikroorganisma. Pada mikro graf yang terhasil juga didapati ada kepulan dapat diperhatikan yang mana membuktikan kehadiran bahan kakisan seperti metal hidroksida serta oksida-oksidanya. Melalui analisis pula, didapati bahawa ferum (kakisan) yang wujud dalam bikar 2 adalah kurang daripada bikar 1. Kehadiran mikroorganisma dalam bikar 1 kesan daripada penggunaan larutan air laut merupakan salah satu penyebab kakisan terbentuk dalam bikar 1.