

EFFECT OF HENNA AT LOW CONCENTRATION IN METHANOL  
FOR THE INHIBITION OF ALUMINIUM IN SEAWATER

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**By**

**Noraliza Binti Abu**

**Research Report submitted in partial fulfillment of  
the requirement for the degree of  
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**Department of Maritime Technology  
Faculty of Maritime Studies and Marine Science  
UNIVERSITI MALAYSIA TERENGGANU  
2013**





**DECLARATION AND VERIFICATION REPORT  
 FINAL YEAR RESEARCH PROJECT**

It is hereby declared and verified that this research report entitled: **Effect Of Henna At Low Concentration In Methanol For The Inhibition Of Aluminium In Seawater** by **Noraliza Binti Abu**, Matric No. **UK 20085** have been examined and all errors identified have been corrected. This report is submitted to the Department of Maritime Technology as partial fulfillment towards obtaining the **Bachelor Degree of Applied Science (Maritime Technology)**, Faculty of Maritime Studies and Marine Science, Unitversiti Malaysia Terengganu.

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## DECLARATION

I hereby declare that this thesis entitled **EFFECT OF HENNA AT LOW CONCENTRATION IN METHANOL FOR THE INHIBITION OF ALUMINIUM IN SEAWATER** is the result of my own research except as cited in the references.

Signature :  .....

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## EFFECT OF HENNA AT LOW CONCENTRATION IN METHANOL FOR THE INHIBITION OF ALUMINIUM IN SEAWATER

### ABSTRACT

Aluminium alloy type AA5083 shows excellent corrosion resistance mostly in seawater and industrial chemical environment. Nowadays, corrosion is entrenched in maritime industry where the ship plate undergoes corrosion and corrosion rate varies with different environment. As a remedy, natural inhibitor was used to overcome this problem. This study is used plant extract which is henna (*Lawsonia Inermis*). Henna was used in this study as an inhibitor towards AA5083. Henna was extracted with methanol as solvent by using rotary evaporator (Rotavap). Low concentration of henna which is 100ppm, 200ppm, 300ppm, 400ppm and 500ppm was used. While for immersion test, the powder form of henna was dissolved in the seawater with different concentration in separate tank. The samples were hang in the test solution for 60 days. The characterization of the corrosion was performed by using potentiodynamic polarization (PP), weight loss (WL), electrochemical impedance spectroscopy (EIS), fourier transform infrared spectroscopy (FTIR) and scanning electron microscope (SEM). The percentage of inhibition efficiency (%) and corrosion rate (CR) was calculated and this study showed that the corrosion rate increase by decreasing concentration of the henna extract. The value for charge transfer resistance, ( $R_{ct}$ ) increase as a result increase the degree of protection of AA5083 in test solution and double layer capacitance, ( $C_{dl}$ ) decrease indicates that a layer was form indicating the formation of a surface film. This reflects the inhibitor does retard the corrosion rate. Extract Lawsone which is the main constituent of henna able to protect AA5083 for this experiment.

Keyword: Aluminium alloy (AA5083), Corrosion inhibitor, Henna extract, Seawater



## KESAN INAI PADA KEPEKATAN RENDAH DALAM METANOL UNTUK PERENCATAN ALUMINIUM DALAM AIR LAUT

### ABSTRAK

Aluminium aloi (AA5083) menunjukkan tahap rintangan yang hebat terhadap kakisan terutamanya di dalam air laut dan kawasan industri kimia, tetapi pada masa kini kakisan menjadi masalah utama di dalam industri maritim dimana plat kapal yang terendam terkakis di dalam kondisi persekitaran pantai yang tidak menentu. Oleh itu, perencat semulajadi digunakan untuk mengatasi masalah ini. Kajian ini telah menggunakan ekstrak tumbuhan yang merupakan inai (*Lawsonia Inermis*). Inai ini telah diekstrak menggunakan pelarut iaitu metanol dengan menggunakan penyejat berputar (Rotavap). Dalam kajian ini telah menggunakan kepekatan rendah iaitu 100ppm, 200ppm, 300ppm, 400ppm and 500ppm. Dalam ujian perendaman, ekstrak inai dilarutkan dalam air laut dengan kepekatan yang berlainan. Sampel tersebut digantung dalam larutan tersebut selama 60 hari. Untuk mengenalpasti kandungan setiap pengestrakan, alat Fourier Transform Infrared Spectroscopy (FTIR) telah digunakan. Tingkah laku kakisan telah disiasat dengan menggunakan beberapa kaedah iaitu ukuran kehilangan berat (WL), ukuran pengutuban potentiodynamik (PP), spektroskopi impedans elektrokimia (EIS) dan mikroskop elektron imbasan (SEM). Pengiraan kecekapan perencatan (%) untuk kehilangan berat, rintangan pengutuban, ketumpatan arus kakisan dan kadar kakisan menunjukkan yang keputusan ekstrak inai menggunakan pelarut metanol mempunyai kecekapan perencatan lebih tinggi. Peningkatan untuk nilai rintangan pemindahan cas, ( $R_p$ ) menunjukkan meningkatnya darjah perlindungan untuk AA5083 dalam larutan penguji dan pengurangan nilai untuk kemuatan dua lapisan, ( $C_{dl}$ ) menunjukkan yang satu lapisan telah terbentuk iaitu pembentukan satu lapisan nipis pada permukaan. Ini membuktikan perencat berfungsi dengan melambatkan kadar kakisan. Ekstrak Lawsone adalah merupakan juzuk utama inai yang mampu untuk melindungi AA5083 dalam eksperimen ini.

Kata kunci: Aluminium aloi (AA5083), Perencat kakisan, Ekstrak inai, Air laut