

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in  
fulfilment of the requirements for the Master of Science

**METABOLITES PROFILING FROM CRUDE EXTRACT AND ESSENTIAL  
OIL OF *Melaleuca cajuputi* FOR ANTIFOULING ACTIVITY**

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Bacteria, barnacles and algae are some examples of marine fouling that can accumulate and attached on motile and moving surface that immersed in water. Due to the issue regarding biofouling that causing problems in maritime, antifouling paint was introduced to prevent the problem. *Melaleuca cajuputi* or gelam was one of the members in family of Myrtaceae that can grow under dry, watery and muddy conditions. The objectives of this study were to identify the antifouling activities of the methanolic crude extract (MCE) and essential oil (EO) and to characterize the metabolites that contributed as antifouling agent. In this study, MCE was produced through maceration using methanol, while EO was obtained via steam distillation. Antibacterial assay of MCE and EO were conducted using disc diffusion method against six bacterial test strains. Crystal violet (CV) assay was conducted to determine the sample that help in preventing the detachment of biofilm produced by marine bacteria, *Pseudomonas aeruginosa*. Chemical profiling was determined by using Thin Layer Chromatography (TLC) and Gas Chromatography-Mass Spectrometry (GCMS). Both samples were incorporated in paint at 5 % and 10 % concentration, painted on steel panels and were immersed in seawater environment to observed the settlement of foulers for three months. Fractionation and isolation of secondary metabolite from MCE were performed using chromatographic techniques and characterization of isolated compound was done using Fourier Transform Infrared

(FTIR) and Liquid Chromatography-Mass Spectrometry (LCMS). MCE exhibits antibacterial activity against Gram-negative bacteria indicating narrow spectrum activity while EO has broad spectrum activity against both Gram-positive and negative bacteria. CV assay show that MCE and EO inhibit the attachment of biofilm. Steel panels painted with paint incorporated with 5 % MCE has better results in inhibit the attachment of micro and macro-foulers. GCMS revealed five organosilicons in MCE and monoterpenes in EO. FTIR provides the information of functional group present in isolated compound such as hydroxyl (O-H) and aliphatic (CH<sub>3</sub>). LCMS identified several possible names for the isolated compound such as acetyleugenol and etrogol. In conclusion, secondary metabolites in *M. cajuputi* have potential to be develop as antifouling agent.

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sebagai memenuhi keperluan untuk Sarjana Sains

**PROFIL METABOLIT DALAM EKSTRAK MENTAH DAN MINYAK PATI  
DARIPADA *Melaleuca cajuputi* UNTUK AKTIVITI ANTILEKATAN**

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Bakteria, teritip dan alga adalah antara beberapa contoh organisma laut yang boleh berkumpul dan melekat pada permukaan pegun dan permukaan bergerak yang tenggelam di dalam air. Oleh kerana isu berkaitan biolekatan memberi masalah dalam bidang maritim, cat anti-lekatan telah diperkenalkan untuk mengelakkan masalah ini. *Melaleuca cajuputi* atau gelam adalah tumbuhan dalam keluarga Myrtaceae yang tumbuh pada keadaan kering, berair dan berlumpur. Objektif kajian ini ialah untuk mengenalpasti aktiviti antilekatan bagi ekstrak mentah metanol (MCE) dan minyak pati (EO) serta untuk mencirikan metabolit yang menyumbang sebagai agen antilekatan. Dalam kajian ini, MCE disediakan daripada proses maserasi menggunakan metanol dan EO diperoleh menggunakan kaedah distilasi stim. Ujian antibakteria untuk MCE dan EO dijalankan menggunakan kaedah penyebaran cakera terhadap enam jenis bakteria. Ujian kristal ungu dijalankan untuk menguji kesan sampel terhadap lekatan biofilem oleh bakteria, *P. aeruginosa*. Profil kimia dikenalpasti menggunakan kromatografi lapisan tipis (TLC) dan spektrometri gas-kromatografi (GCMS). Kedua-dua sampel dicampurkan ke dalam cat untuk dicat pada panel besi dan direndam ke dalam laut selama tiga bulan untuk mengamati lekatan fouler. Fraksinasi dan pencirian kompaun dalam MCE dilakukan menggunakan kaedah kromatografi dan pencirian menggunakan spektrometer transformasi inframerah (FTIR) dan kromatografi cecair spektrometri (LCMS). MCE mempunyai aktiviti

terhadap bakteri Gram-negatif menunjukkan spektrum kecil manakala EO mempunyai spektrum meluas terhadap Gram-positif dan negatif bacteria. Ujian kristal ungu menunjukkan kedua-dua sampel menghalang pelekatan biofilem. Panel besi yang dicat dengan 5 % MCE mempunyai kesan terhadap lekatan mikro dan makrofouler yg baik. GCMS menunjukkan lima organosilikon dalam MCE dan monoterpen dalam EO. FTIR memberi informasi tentang kumpulan berfungsi yang terdapat dalam kompaun seperti hidroksi (O-H) dan alifatik (CH<sub>3</sub>). LCMS mengenalpasti beberapa nama yang mungkin bagi kompaun pencilan seperti acetyleugenol dan etrogol. Konklusinya, metabolik sekunder dalam *M. cajuputi* mempunyai potensi sebagai agen antilekatan.