

WAN NOAZIRA WAN ADNAN DOCTOR OF PHYLLOSOPHY 2019

**THE ANAESTHETIC EFFECTS OF
LEMONGRASS, *Cymbopogon citratus*
ESSENTIAL OIL ON GIANT
FRESHWATER PRAWN,
*Macrobrachium rosenbergii***

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**DOCTOR OF PHYLOSOPHY
UNIVERSITI MALAYSIA TERENGGANU**

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**Thesis Submitted in Fulfilment of the Requirement for the Degree of Doctor of
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Universiti Malaysia Terengganu**

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ESSENTIAL OIL ON GIANT FRESHWATER PRAWN, *Macrobrachium rosenbergii***

WAN NOAZIRA BT WAN ADNAN

2019

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Research (AKUATROP)**

Stress is a critical state in the phase of aquaculture management that would lead to the decrease production and eventually death. Anaesthetics are widely being used as it capable in reducing mortality through progressive loss of mobility, equilibrium and consciousness, which can facilitate husbandry activities. Thus, the aim of this study was to determine the potential of lemongrass, *Cymbopogon citratus* essential oil as an anaesthetic on giant freshwater prawn, *Macrobrachium rosenbergii*. There were four objectives for this study; (i) to extract the essential oil from *C. citratus* and to determine its chemical compounds, (ii) to investigate the efficacy of *C. citratus* essential oil as an anaesthetic through concentration-response trials and determine its lethal concentration value (LC₅₀), (iii) to investigate the effectiveness of *C. citratus* essential oil as an anaesthetic through the induction and recovery time analysis and (iv) to determine the effect of *C. citratus* essential oil on *M. rosenbergii* hemolymph as indicator of stress response. The extraction of *C. citratus* through hydrodistillation and the analysis using Gas Chromatography-Mass Spectrophotometer demonstrated citral as a major compound with 78.47%. The LC₅₀ values of 24, 48, 72 and 96

hour were 85.81, 73.41, 61.81 and 53.84 $\mu\text{l/l}$. The induction time demonstrated that the essential oil of *C. citratus* was able to induce *M. rosenbergii* at optimal concentration of 500 $\mu\text{l/l}$ within 5.38 ± 1.78 min at light sedation stage, and 15.55 ± 6.33 min at totally loss equilibrium stage with recovery time at 9.50 ± 3.17 min. The metabolic response (hemolymph glucose, lactate and LDH) of *M. rosenbergii* were increased and hemolymph glycogen was decreased when exposed to handling stress over the group in the presence of *C. citratus* essential oil. Hemolymph protein and enzymes (MDH, ALT and AChE) were not significantly different ($p > 0.05$) with control treatment. Higher level of glucose and lactate, the decrease of glycogen and unaltered protein level in hemolymph of stressed *M. rosenbergii* indicated that *M. rosenbergii* used the carbohydrate metabolism as secondary metabolic response to cope with the handling stress. Thus, the present study showed that, the *C. citratus* essential oil was capable to sedate and reduce the stress response on *M. rosenbergii*.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**KESAN ANESTETIK SERAI, *Cymbopogon citratus* KE ATAS UDANG GALAH,
*Macrobrachium rosenbergii***

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Perikanan (AKUATROP)

Tekanan adalah kritikal di dalam fasa pengurusan akuakultur yang akan membawa kepada pengurangan hasil pengeluaran dan akhirnya kematian. Pembiusan digunakan secara meluas kerana ia mampu mengurangkan kematian melalui pengurangan pergerakan yang agresif, keseimbangan dan kesedaran melalui penekanan pada sistem saraf di dalam otak yang boleh memudahkan aktiviti penternakan. Oleh itu, matlamat kajian ini adalah untuk menentukan potensi pati minyak serai, *Cymbopogon citratus* sebagai anestetik kepada udang galah, *Macrobrachium rosenbergii*. Terdapat empat objektif bagi kajian ini; (i) mengestrak pati minyak daripada serai, *C. citratus* dan menentukan sebatian kimia (ii) mengkaji keberkesanan pati minyak *C. citratus* sebagai anestetik melalui ujian kepekatan-tindakbalas dan menentukan nilai kepekatan kematian (LC₅₀), (iii) mengkaji keberkesanan pati minyak *C. citratus* sebagai anestetik melalui analisis masa induksi dan pemulihan serta iv) menentukan kesan pati minyak *C. citratus* keatas darah *M. rosenbergii* sebagai penunjuk kepada tindakbalas tekanan. Pengestrakan pati minyak *C. citratus* melalui penyulingan air dan analisis menggunakan Gas Chromatography-Mass Spectrophotometer menunjukkan

citral sebagai sebatian utama dengan 78.47%. Nilai LC_{50} 24, 48, 72 dan 96 jam adalah 85.81, 73.41, 61.81 and 53.84 μ l/l. Masa induksi mendapati bahawa pati minyak *C. citratus* mampu menginduksi *M. rosenbergii* pada kepekatan optima 500 μ l/l dalam masa 5.38 ± 1.78 min pada 'light sedation stage' dan 15.55 ± 6.33 min pada 'totally loss equilibrium stage' dengan masa pemulihan pada masa 9.50 ± 3.17 min. Tindakbalas metabolic *M. rosenbergii* (glukos, laktat dan LDH) adalah meningkat dan kepekatan glikogen menurun apabila didedahkan kepada tekanan pengendalian berbanding dengan kumpulan yang terdapat pati minyak *C. citratus* (T1). Sementara itu, kepekatan protin dan enzim (MDH, ALT dan AChE) adalah tidak signifikan ($p > 0.05$) dengan rawatan kawalan. Peningkatan kepekatan glukos dan laktat, penurunan glikogen dan protin yang tidak berubah didalam darah *M. rosenbergii* menunjukkan udang menggunakan metabolisme karbohidrat sebagai tindakbalas metabolik kedua untuk mengatasi tekanan pengendalian. Oleh itu, kajian ini menunjukkan pati minyak serai, *C. citratus* mampu untuk melali dan mengurangkan tekanan pada *M. rosenbergii*.