

**THE DEVELOPMENT OF MICROEMULSION
BASED ANODYNE ULTRAVIOLET (UV)
FILTERS INCORPORATED WITH
Melaleuca cajuputi EXTRACT**

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**MASTER OF SCIENCE
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School : School of Fisheries and Aquaculture Sciences

For the past few decades, herbal sunscreen have brought major attraction due to their beneficial value such as high ultraviolet ray absorption. Besides, it also has great potential to possess antibacterial activity. Due to these advantages, a series of sunscreen formulations with the combination of herbal extracts were proposed. In this study, four formulations were successfully developed with different composition comprises of nonionic surfactant, co-surfactant, water and essential oil of *Melaleuca cajuputi* as active ingredient. The percentage ratio by weight of surfactant:co-surfactant:water were F1 (28:22:50), F2 (10:10:80), F3 (26:24:50) and F4 (30:20:50). This study was also conducted to explore the ability of *M. cajuputi* to promote a good anodyne ultraviolet (UV) filter which can lead to improvement in the treatment of sun burn due to the overexposure to UV radiation. All of the sunscreen formulations based on microemulsion system as the medium were formulated and analyzed using several spectroscopic and analytical techniques such as Gas Chromatography-Mass Spectroscopy (GC-MS), ternary phase diagram, UV-visible Spectroscopy, morphology of sample surface by Scanning Electron

Microscope (SEM), rheological behavior, conductivity by Electrochemical Impedance Spectroscopy (EIS), antibacterial activity, cytotoxicity, and skin analysis. Additionally, the color, pH, and Sun Protection Factor (SPF) of each formulations were also determined. The results revealed that formulation 4 which consisted of Tween 80 as nonionic surfactant, olive oil as co-surfactant, water, as well as *M. cajuputi* essential oil demonstrated highest stability of oil-in-water microemulsion formulation compared to the formulations 1, 2 and 3. Moreover, this formulation also exhibits high SPF value and good performance towards human skin application. Overall, it can be potentially commercialize as hybrid innovation sunscreens formulation in increasing the efficiency of skin prevention from UV radiation.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu
sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

**PEMBANGUNAN PENAPIS ANODIN ULTRA LEMBAYUNG
BERASASKAN MIKROEMULSI DENGAN PENAMBAHAN EKSTRAK
*Melaleuca cajuputi***

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Sejak beberapa dekad yang lalu, pelindung matahari berasaskan herba telah membawa tarikan utama kerana nilai faedah mereka seperti penyerapan tinggi terhadap sinar ultralembayung. Selain itu, ia juga mempunyai potensi yang besar bagi keupayaan anti-bakteria. Disebabkan oleh beberapa kelebihan ini, satu siri formulasi pelindung matahari dengan gabungan ekstrak herba telah dicadangkan. Dalam kajian ini, empat formulasi telah berjaya dibangunkan dengan komposisi yang berbeza yang terdiri daripada surfaktan bukan ionik, surfaktan-bersama, air dan minyak pati *M. cajuputi* sebagai bahan aktif. Nisbah peratusan mengikut berat bagi surfaktan: surfaktan-bersama: air adalah F1 (28:22:50), F2 (10:10:80), F3 (26:24:50) dan F4 (30:20:50). Kajian ini juga dijalankan untuk menyiasat keupayaan *M. cajuputi* bagi menggalakkan penapis ultralembayung yang lebih baik yang boleh membawa peningkatan dalam rawatan selaran matahari disebabkan oleh pendedahan berlebihan kepada sinaran ultralembayung. Kesemua formulasi pelindung matahari berasaskan sistem mikroemulsi sebagai medium telah dirangka dan dianalisis menggunakan beberapa spektroskopi dan teknik analitikal seperti Kromatografi

Gas-Spektroskopi Jisim (GC-MS), gambarajah fasa pertigaan, Spektroskopi Ultralembayung-Nampak, morfologi permukaan sampel oleh Mikroskop Imbasan Elektron (SEM), tingkah laku reologi, kekonduksian oleh Spektroskopi Impedans Elektrokimia (EIS), aktiviti anti-bakteria, sitotoksik, dan analisis kulit. Selain itu, warna, pH, dan faktor perlindungan matahari (SPF) setiap formulasi juga telah dapat ditentukan. Hasil kajian menunjukkan bahawa formulasi 4 yang terdiri daripada Tween 80 sebagai surfaktan bukan ionik, minyak zaitun sebagai surfaktan-bersama, air, dan juga minyak pati *M. cajuputi* menunjukkan kestabilan tertinggi untuk penggubalan mikroemulsi minyak dalam air berbanding dengan formulasi 1, 2 dan 3. Selain itu, formulasi ini juga mempamerkan nilai SPF yang tinggi dan prestasi yang baik terhadap penggunaan ke atas kulit manusia. Secara keseluruhan, ia berpotensi untuk dikomersilkan sebagai formulasi hibrid pelindung matahari dalam meningkatkan keberkesanan bagi pencegahan kulit daripada sinaran ultralembayung.