UNIVERSITI TEKNOLOGI MARA

INFLUENCE OF PRESSURE AND TEMPERATURE ON THE SOLUBILITY OF SUPERCRITICAL CARBON DIOXIDE TO EXTRACT INSECTICIDAL COMPOUNDS FROM PELARGONIUM RADULA LEAVES

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ABSTRACT

Pelargonium radula (*P. radula*) is one of aromatic plants that contains insecticidal compounds that has the ability to fight against mosquitoes. In spite of citronella oil is a common natural-based mosquito repellent product, researches prove that citronella oil can give negative effects especially towards human skin. Therefore, *P. radula* has been chosen in this research. Based on previous research, solvent extraction and hydrodistillation extraction techniques are commonly being implemented to extract the insecticidal compounds in medicinal and aromatic plants regardless the side effect of all those traditional methods. These traditional extraction methods require longer extraction time, higher operating temperature and need organic solvent to extract the constituents in the plants that might result in toxic residual at the end of the extraction process. These might lead to chemical alteration and loss of volatile compound within the plant as well as give a negative effect to human and environment. In order to fill in the gap of the traditional extraction techniques, supercritical fluid extraction (SFE) method is being used to extract the compounds in *P. radula* plant in which the solvent used is environmental friendly and saves times. The extraction was conducted within a range of temperature (40 °C, 45 °C, 50 °C, 55 °C, and 60 °C) and pressure (100 bar, 150 bar, 200 bar, 250 bar, 300 bar, 350 bar, and 400 bar) a constant solvent flowrate 24 ml/min for 80 minutes extraction. The components within the extracted oil was analysed by using Gas Chromatography (GC) and Gas Chromatography-Mass Spectrometry (GC-MS). Once the extracted oil has been obtained, the effect of operating temperature and pressure was determined and being used to evaluate the potential of mosquito repellency. Based on the result obtained, the highest extraction yield with percentage of 1.7474 % as well as the solubility were obtained at the highest operating conditions with temperature and pressure of 60 °C and 400 bar, respectively. Meanwhile, as being analysed by GC and GC-MS, there are eight compounds were found which are geraniol (12.5488 %), citronellol (7.0016 %), 10-epi-γ-eudesmol (3.7782 %), dauca-5,8-diene (1.8524 %), menthone (1.2328 %), germacrene D (0.9174 %), geranyl tiglate (1.1658 %), and delta-cadinene (0.3440 %). Finally, the extracted *P. radula* oil was found to be effective in repelling mosquito as concentration of 5%.

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CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Pelargonium radula (P. radula) or locally known as 'Pokok Halau Nyamuk' or 'Jeremi' is one of medicinal and aromatic plant that benefits human-being. Nowadays, people have a positive point of view when it comes to medicinal and aromatic plants because of its component that benefits human-being. Even centuries ago, people use all those plants for a lot of purpose such as cure disease, beauty, food preservation and others. *P. radula* is a genus *Pelargonium* species that belongs to *Geraniaceae* family that native to South Africa. Basically, this species is widely used in industries especially perfumery, cosmetics, and aromatherapy industries (Asgarpanah & Ramezanloo, 2015). Each parts of *Pelargonium* plant has it significant role to people for instance, traditionally, the leaves of *Pelargonium* plant is used as herbal tea to treat tonsillitis, enhance blood circulation and fight anxiety (A. Peterson et al., 2006). As referring on the recent studies, researchers found that *Pelargonium* plant consists of antioxidant, antibacterial, antifungal activities and acaricidal properties in which believed have a significant value towards human (Asgarpanah & Ramezanloo, 2015).

Statistics of dengue cases early of the year 2018 shows a huge numbers in which 1072 and 1066 cases were faced by Malaysian in the fourth and fifth week of the year 2018, respectively. In addition, 34 cases of Chikungunya that caused by aedes were also being reported. Most of mosquito repellent that being commercialize was made from synthetic substances that may give harm to environment and also the person that using it. Therefore, *P. radula* leaves has been selected as an alternative to prepare for an environmental friendly mosquito repellent product. As referred to several literatures on composition in *P. radula* leaves, the essential oil extract consists of citronellol and geraniol component in which known for its ability to beat off mosquito (Asgarpanah & Ramezanloo, 2015). This result can be supported by a study on *P. radula* extracts in which both compounds of citronellol and geraniol were found within the extracted oil by using solvent extraction and hydrodistillation technique (S.Asnawi, 2008).