

UNIVERSITI TEKNOLOGI MARA

**CHARACTERIZATION OF CITRUS
LEMON (PEEL SKIN) OIL BY USING
SOXHLET EXTRACTION**

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ABSTRACT

Citrus Lemon fruit is one of the most popular citrus species due to its benefits in many applications. This fruit is very well known for widely being used in food industry, especially in the production of juice. However, after being separated from the fruit that being used to produce juice, its peels usually being abandoned and thrown away. Surprisingly, this part of citrus lemon by-product actually can be useful and believed to contain components that have potential to bring many benefits to human especially for the health issues. In addition, the environmental problems caused by the waste product from this fruit which typically not being handled in a proper way can be eliminated or at least can be reduced. The extraction method that known as Soxhlet Extraction by using the organic solvents will be used in this study. This extraction method was chosen due to the factors such as the simplest method, its potential to produce the higher amounts of essential oil as well as inexpensive. This work has two main objectives which are to determine oil yield in citrus lemon (peel skin) by using Soxhlet Extraction method and to determine the components exist in citrus lemon (peel skin) by using Gas Chromatography Mass Spectrometry (GCMS) Analysis and functional group of citrus lemon peel by using Fourier Transform Infrared Spectroscopy (FTIR) Analysis. As being mentioned in the objectives, this study was conducted by using several main equipments which are Soxhlet Extractor and rotary evaporator at Fluid Mechanics Laboratory as well as GCMS and FTIR equipment at Instrumentation Laboratory, Faculty of Chemical Engineering, UiTM Shah Alam. The highest percentage of oil yield was found to be by using Chloroform as a solvent with 30.6627%. The results were followed by Acetone and n-Hexane with percentage of oil yield 30.0613% and 27.4790% respectively. The GCMS analysis has shown positive results. Firstly, for the extraction of oil by using Chloroform as a solvent, there are three main components were found to be dominant which are Coumarin, α -Pinene and Psoralens (Furanocoumarins). As by using Acetone as a solvent in extraction, the dominant main compound were Benzoic acid and Phenol. Meanwhile by using n-Hexane as a solvent, the dominant component was n-Hexadecanoic acid. The FTIR Analysis with objective to determine the functional group was conducted successfully as well. By using Chloroform as a solvent, the functional groups presented were Aliphatic primary amine, Alkene, Alkane, Vinyl Ether and Esters. As for by using Acetone, the functional groups were found to be Alcohol, Alkane, Nitro compound, Vinyl Ether, Halo compound, Esters, Aliphatic primary amine, Imine / Oxime, Sulfuric acid and Alkene. Meanwhile for by using n-Hexane, the functional groups presented were Aliphatic primary amine, Alkane, conjugated Aldehyde, Nitro compound, Alkyl Aryl Ether, secondary Alcohol, Alkene, Alcohol, primary Alcohol and Imine / Oxime.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

Citrus species is one of the most popular world fruit crops contain active phytochemicals. The example for citrus plants such as lemon, mandarin, lime, orange, sour orange and grapefruit belonging to the family of Rutaceae. This species is very well known as the species to supply many beneficial nutrients that may bring benefits to human being. The beneficial components that believed to be contains and provides by this species are folic acid, potassium, pectin and vitamin C. In addition, this species also proven to contribute to the prevention of life threatening diseases (Rafiq et al., 2018).

According to (Chaturvedi & Shrivastava Suhane, 2016) citrus lemon is the fruits that classified as citrus species and hybrid of the plant genus. Citrus lemon main characteristic is thorny branches, having white flowers, with purple edges, acidic, oval shaped juicy fruit, aromatic rind with yellow colour when ripe and also on it blossom end will have prominent bulge. This type of fruit is considered as an important medicinal plant of the Rutaceae family where the origin was from tropical and subtropical Southeast Asia. In crude extracts of different parts such as the viz, root, stem, leaves and flower of the lemon are proved to against clinically significant in bacterial strains. As for the lemon peel which is one of the waste or by-products from citrus lemon, this part contained of crude fibres (15.18%), crude fat (4.98%) and protein (9.42%). Besides, the lemon peel also contains of ash up to 6.26% and 5% acid contains in lemon juice causing lemon to have a sour taste where the pH is in the range of 2 to 3.

(Makni, Jemai, Kriaa, Chtourou, & Fetoui, 2018) stated that the number of world production for lemon are about 4,200,000 metric tons and this fruit is third most important citrus species after orange and mandarin. In fact, citrus lemon one of the species which is very rich with many important natural compounds such as citric acid, ascorbic acid, flavonoids, minerals as well as essential oil. Citrus fruits species typically widely use in food industries such as to produce fresh juice. Due to the reason that this species very rich in many important natural compounds especially in bioactive