

**THE EXTRACTION AND DETECTION OF LIMONENE
(4-ISOPROPHENYL-1-METHYL CYCLOHEXENE) FROM CITRUS PEEL USING
HEADSPACE SOLID PHASE MICRO-EXTRACTION (HS - SPME) AND GAS
CHROMATOGRAPHY WITH MASS SPECTROMETRY
(GC-MS)**

NUR HUSNA BINTI ZAINAL ABIDIN

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ABSTRACT

THE EXTRACTION AND DETECTION OF LIMONENE (4-ISOPROPHENYL-1-METHYL CYCLOHEXENE) FROM CITRUS PEEL USING HEADSPACE SOLID PHASE MICRO-EXTRACTION (HS - SPME) AND GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY (GC-MS)

Waste citrus peels can be used as source of several bioactive compounds. Among these, limonene is the major constituent from citrus peels and is of great interest in several fields. In this study, the analysis of volatile compounds in four citrus peel samples, specifically limonene, was carried out using headspace solid – phase microextraction and gas chromatography – mass spectrometry detector to detect and relatively quantify the amount of limonene in all of the citrus peel samples. The conditions of SPME were optimized. The optimized extraction temperature, extraction time and desorption time were 70 °C, 40 min and 100 sec respectively. The retention time (t_R) for limonene in this study was 11.70 min. It was found that limonene was detected in all four citrus peel samples. Kaffir lime peel has the highest peak area of limonene which was 8.23×10^9 while key lime peel has the lowest peak area of limonene which was 3.24×10^9 .

CHAPTER 1

INTRODUCTION

1.1 Background and problem statement

Citrus fruits belong to the family of Rutaceae. Citrus are well known as one of the world's major fruit crops that are produced in many countries with tropical or subtropical climate. Citrus fruits and their by-products are of high economic and medicinal value because of their multiple uses such as in the food industry, cosmetics, and folk medicine. In addition to large scale consumption as fresh fruits, the citrus fruits are mainly processed to produce juice. The waste of citrus processing industry left after juice extraction such as peels, seeds, and pulps, corresponding to about 50% of the processed fruit, can be used as a potential source of valuable products (Kamal *et al.*, 2011).

Almost the citrus crops are industrially processed for juice production, where peels segment membrane end up as waste. These solid residues are referred to as citrus wastes (CWs) with estimated worldwide production of 15 million tons per year. Currently, parts of the CWs are dried and marketed as low-protein cattle feed called "citrus pulp pellets" and the rest are disposed in landfills, constituting severe economic and environmental problems (Mehdi *et al.*, 2010).