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# The Effect of Solvent Type on Oil Yield on Essential Oil of Sweet Orange Peel Extract (Citrus X Sinensis)

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Type of Solvent; Oil Yield; Sweet Orange Peel (Citrus X Sinensis)

**ABSTRACT**

**Introduction**: Citrus fruits can be processed into various types of preparations that are very useful. Sweet orange (Citrus X sinensis) is a type of orange that is consumed by squeezing it into a drink. So far, sweet orange peels (Citrus X sinensis) have not been fully utilized and become waste that is thrown away. Meanwhile, the peels of citrus fruits have useful content, so that the peels of citrus fruits can be processed into products that are useful for the community. Wet sweet orange peel is better to use than dried sweet orange peel. This is because the sweet orange peel contains essential oils which have not completely evaporated so that the oil can be taken directly.
**Method**: This research is a laboratory-based experimental study.
**Results**: From the analysis, it was found that the water content of sweet orange peel was 75.5%. The results of data analysis showed that the highest oil yield was obtained using the soxhletation method for 12 hours using 6.15% hexane as a solvent, 4.89% ethanol as a solvent, and 1.67% aquadest as a solvent. When compared to these three solvents, hexane solvent is more effective than ethanol and aquadest. It shows that in general the essential oil from lime peel produced is still within the range of essential oil quality standards based on ISO 3519:2005.
**Conclusion**: In this study, the best solvent was hexane. The sweet orange peel essential oil produced has a greenish yellow color for hexane and aquadest solvents and yellowish green for ethanol solvents. The essential oil produced has a density of 0.8580 g/cm3.

## INTRODUCTION

Oranges are one of the fruit commodities that have an important role in the domestic and world markets, both in fresh and processed forms (1). In Indonesia, the production and demand for oranges is second only to bananas. Citrus fruit itself can be processed into various types of preparations that are very useful (2). Sweet orange (Citrus sinensis) is a type of orange that is consumed by squeezing it into a drink. So far, sweet orange peels (Citrus X sinensis) have not been fully utilized and become waste that is thrown away. Meanwhile, the peels of citrus fruits have useful content, so that the peels of citrus fruits can be processed into products that are useful for the community. Wet sweet orange peel is better to use than dried sweet orange peel. This is because the sweet orange peel contains essential oils which have not completely evaporated so that the oil can be taken directly. In addition, the aroma obtained from the essential oil is still fresh with a distinctive citrus fruit smell (3).

Currently, consumers tend to prefer natural and environmentally friendly perfumes made from pure, safe ingredients (4). Therefore, we need materials that are able to provide a fragrance or fragrance that is much liked by consumers who come from natural ingredients. One of the additives that can be used as a fragrance is essential oils.

Various extraction methods are used in the manufacture of essential oils, the method used usually depends on what type of plant is used. In other words, the method used to obtain essential oils depends on what kind of plant will be extracted (5).

One of them is soxhletation. Soxhletation is one of the traditional methods using solvents. Soxhlet extraction tools have several advantages, one of which can reduce the use of organic solvents because the sample will be repeatedly contacted with fresh solvent. Another advantage of this method is that the time used is more efficient and the extraction process will run continuously without having to increase the volume of solvent so that a more concentrated extract will be obtained (6).

The purpose of this study was to determine the type of solvent that is good for producing essential oil from sweet orange peel (citrus sinensis) and to determine whether the quality of essential oil from sweet orange peel complies with ISO 3519:2005.

## METHODOLOGY

This research is a laboratory-based experimental research. The research was conducted at the Pharmacy Laboratory of Aufa Royhan University in Padangsidimpua City for 4 months in 2020. The materials used in this study were sweet orange peel (citrus sinensis), ethanol, aquades and n-hexane. The tools used in this research are glass utensils such as Erlenmeyer, glass beaker, measuring cup, soxhletizer, analytical balance, oven, hotplate.

Sample preparation was carried out by collecting sweet orange peels from the Sipirok subdistrict, South Tapanuli Regency, the water content of the orange peel was calculated to determine the amount of water content contained therein. The orange peel was dried and mashed then sieved with a 60 mesh sieve.

Sweet orange peel powder weighed as much as 20 grams. The sweet orange peel powder is wrapped in filter paper and put in a thimble. The solvent in the form of ethanol was put into a 200 ml flask and then heated at a temperature of 78oC (according to the boiling point of the solvent) for 6, 9, and 12 hours. After the extraction is complete, the extract obtained is separated between the oil and the solvent using a vacuum rotary evaporator. The experiment was repeated for time variations and other solvents (n-hexane and aquadest). The extracted oil will calculate the oil yield and analyze the color and density of the oil.

## RESULTS AND DISCUSSION

This research was conducted to determine the best type of solvent to extract essential oil from sweet orange peel. The raw material in this study was sweet orange peel obtained from the Sipirok sub-district. Sweet orange peel was dried in an oven, then mashed with a blender, and sieved using a 60 mesh sieve. Sweet orange peel powder measuring 60 mesh is used every run as much as 20 grams. The method used in this research is soxhletation. There are 3 solvents used in this sweet orange peel extraction, namely hexane, ethanol, and aquadest with an extraction time of 12 hours. From the analysis results obtained that the water content of sweet orange peel is 75.5%.

### The Effect of Solvent Type on Oil Yield on the Extraction of Sweet Oil Skin Essential Oil

Selection of the right solvent is one of the important factors in extraction. Selectivity, solubility, cost, and safety must be considered. Solvents with polarity values that are close to the polarity of the solute tend to have better performance and vice versa (7). In this study, the essential oil of lime peel was obtained using three solvents, namely hexane, ethanol, and aquadest. The use of three different types of solvents aims to compare the yield of the extracted oil so that it can be seen which solvent is more effective. The data for obtaining the best lime peel oil yield on each type of solvent can be seen in Figure 1

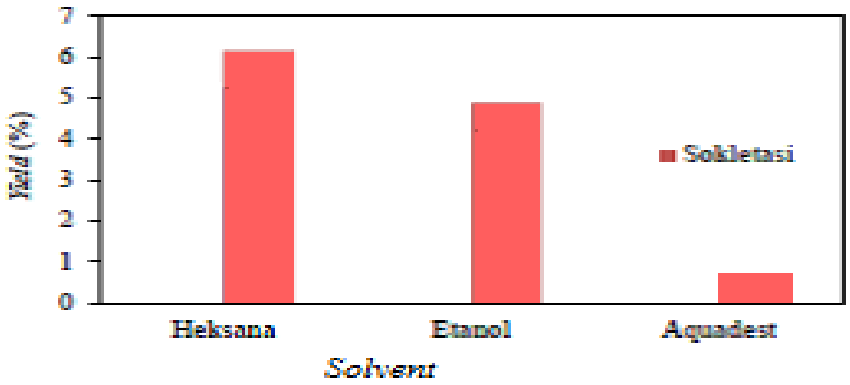


**Figure 1.** Obtaining Lime Peel Oil Yield Using Hexane, Ethanol, and Aquadest Solvents

Figure 1 shows the highest oil yield obtained using the soxhletation method for 12 hours using 6.15% hexane as a solvent, 4.89% ethanol as a solvent, and 1.67% aquadest as a solvent. When compared to these three solvents, hexane solvent is more effective than ethanol and aquadest. The results of this study have similarities with research by Lee, et al (2017) who extracted essential oil from agarwood leaves using 4 different solvents, namely aquadest, ethanol, isopropanol, and hexane where extraction using hexane solvent had the highest yield (8). The solute will be more soluble in the solvent if the two have a fairly close polarity. Sweet orange peel oil is a non-polar compound which tends to dissolve in non-polar solvents as well where hexane, ethanol, and aquadest have a polarity index of 0.1 ; 3.9 ; and 10.2. The greater the polarity index, the more polar the compound. Therefore, hexane will more easily dissolve sweet orange peel oil because of its non-polar nature so that the yield obtained will be greater than ethanol and aquadest. However, the extraction using aquadest with the soxhlet method cannot be carried out. In soxhlet extraction, there are several requirements from the solvent, namely the solvent is more volatile, the boiling point of the solvent is low, and the nature of the compound to be extracted is in accordance with the solvent. Among hexane, ethanol, and aquadest, aquadest is a solvent with a higher boiling point and more difficult to evaporate than the other two solvents. The properties of sweet orange peel oil compounds and aquadest are also different, where aquadest is a polar compound and hexane is a nonpolar compound. So that the extraction process using the soxhletation method using aquadest solvent cannot be done. Aquadest can be used as a solvent if it is mixed with other non-plar solvents in a certain ratio as done by (6).

**Quality Analysis of Essential Oil From Lime Skin With Iso 3519:2005 Parameters**

The results of the extraction of essential oil from sweet orange peel were analyzed for characteristics and compared with the quality standard of sweet orange peel oil based on ISO 3519:2005 as shown in table 1

**Table 1.** Results of Qualitative Analysis of Sweet Orange Peel Essential Oil

| Parameter | Extracted Sweet Orange Peel Essential Oil | Sweet Orange Essential Oil according to ISO 3519 : 2005 |
|---|---|---|
| Color | Hexane: Greenish yellow<br>Ethanol: Yellowish green<br>Aquadest : Greenish yellow | Colorless to greenish yellow |
| Dencity, $20^0$C (g/cm$^3$) | 0,858 | 0,858-0,866 |

Table 1 shows that in general the essential oil from sweet orange peel produced is still within the range of essential oil quality standards based on ISO 3519:2005.

**CONCLUSION**

The conclusion of this research is that the solvent used in the extraction will affect the yield of the essential oil. In this study, the best solvent was hexane. The sweet orange peel essential oil produced has a greenish yellow color for hexane and aquadest solvents and yellowish green for ethanol solvents. The essential oil produced has a density of 0.8580 g/cm3.

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