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Isolation of Linalool From Coriander Seeds by Soxhlet Extraction Method

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Abstract. Isolation of linalool from coriander seeds by sohxlet extraction method – steam distillation has been carried out. This study used solvent variables, namely ethanol, hexane, a mixture of ethanol-hexane ratio of 1:1, and the variable mass of coriander seeds was 30, 35, 40, and 45 grams. This study aims to determine the right solvent to isolate linalool and determine the best yield that can be produced. Coriander seed powder was put into the Sohxlet extractor by adding 400 ml of solvent to isolate the linalool, then the solvent was separated using steam distillation. The extracts obtained were analyzed for the amount of yield, density, linalool functional groups using FTIR. From the research, it was found that ethanol solvent could isolate the most linalool with a yield of 31.52% and a density of 0.8667 gr/ml. In the mass variable, the largest yield was found in the mass of 30 grams of coriander powder by 39.3% and the density of 0.8670 gr/ml. The FTIR analysis showed the average wave number of –OH at 3316 - 3328 cm^{-1} and group C=C at 1641 cm^{-1}.

INTRODUCTION

Coriander (Coriandrum sativum) is a popular spice plant. Coriander is an annual herbaceous plant, and is generally cultivated on a limited basis in the highlands such as in Boyolali, Salatiga, Temanggung, West Sumatra, and others. Based on the shape of the fruit, it can be divided into three types, small round fruit, large round, and oval [1]. The crops are generally sold to traditional markets for household spices. Coriander has a distinctive aroma caused by the chemical components contained in the essential oil. Coriander oil (coriander oil) is an essential oil-producing commodity which is estimated to have high commercial potential and value. Coriander has an essential oil content ranging from 0.4 to 1.1%.

The main component of coriander oil is linalool which amounts to around 60-70% which can be used as raw material for perfumes, pharmaceuticals, food and beverage aromas, bath soaps, candles, laundry soaps, synthesis of vitamin E and pesticides and insecticides. The other supporting components are geraniol (1.6-2.6%), geranyl acetate (2-3%), camphor (2-4%) and contain about 20% hydrocarbon group compounds [2]. Several studies have shown the benefits of coriander solution, including as a preservative in Lombok tofu [3], lowering blood pressure [4] and treating vaginal discharge problems [5].

There are many plant-derived terpenoids with analgesic effects, one of which is linalool. Linalool is a volatile compound found in many plant tissues, namely leaves, fruit, and generally flowers. Linalool is a terpenoid alcohol compound, in liquid form, colorless, fragrant and has an empirical formula of $C_{10}H_{18}O$, and a structural formula of 3,7 dimethyl-1,6 octadien-3-ol. Linalool is a straight chain alcohol compound. The linalool compound is a

component that determines the intensity of the fragrant aroma, so coriander oil can be used as a raw material for perfume, the aroma is like lavender oil [2].

Linalool is antinociceptive which has the potential to act on the muscarinic, opioid, dopaminergic, adenosinergic, and glutamatergic systems and ATP-sensitive K+ channels [6]. Linalool was also found as a sedative and anesthetic in one fish species, Rhamdia quelen [7]. Studies from [8] that Administration of linalool @ 120 mg/kg protects cell membranes from oxidative stress. Several studies have also shown that linalool can act as anticancer [9]. While research from shows that the linalool compound extracted from lavender flowers has a sedative effect on reducing the risk of insomnia [10].

Based on [11] review, reflux extraction is the most commonly employed technique for preparative separation. The Soxhlet extraction method integrates the advantages of the reflux extraction and percolation, which utilizes the principle of reflux and siphoning to continuously extract the herb with fresh solvent. Research on linalool isolation using soxhlet extraction with various solvents and masses to determine the optimum yield of linalool compounds is still an interesting research to do.

METHODS

This research is divided into several stages according to the parameters studied. In this case, the parameters to be studied are the influence of the solvent and the mass of the sample. Coriander oil extraction was carried out using a variable solvent of ethanol, hexane and a mixture of ethanol-hexane 1:1. After the solvent variable produced the highest yield, followed by the mass variable from coriander with variables 30, 35, 40, and 45 grams. Coriander seeds are powdered, then wrapped in filter paper and put into a Sokhlet extractor. Extraction was carried out by adding 300 mL of solvent into a round bottom flask and extraction was carried out at the boiling point of the solvent. Coriander oil and solvent are separated from the solvent by distillation, until pure coriander oil is obtained. To determine the content of chemical compounds in coriander oil, analysis was carried out using FTIR. Figure 1 is the process of extracting coriander oil.

FIGURE 1. Coriander Seed Oil Extraction Process Soxhlet Extraction

RESULTS AND DISCUSSION

Yield and Density Analysis

Based on the results of the solvent variables tabulated in Table 1, it was found that ethanol solvent produced the highest yield of 31% with the density of the oil produced was 0.8867. The presence of –OH groups in ethanol and linalool (figure 2) is estimated to have close polarity of ethanol and linalool so that ethanol is able to produce higher yields than hexane or ethanol-hexane mixtures. All stages of extractions, from the pre-extraction and extraction are equally important in the study of medicinal plants. The sample preparation such as grinding and drying affected the

efficiency and phytochemical constituents of the final extractions; that eventually have an effect on the final extracts [12].

TABLE 1. Experimental Results of Solvent Variables

Solvent	Coriander mass (gram)	Oil mass (gram)	Oil volume (ml)	Yield (%)	Oil density (gr/ml)
Heksana	45	4.5404	5.3	10.0898	0.8567
Etanol	45	14.1864	16	31.5253	0.8867
Et : Hx = 1:1	45	9.8013	12	21.7807	0.8168

Furthermore, experiments were carried out with the coriander mass variable using ethanol as a solvent. Based on the results from Table 2, the largest yield was produced by 30 grams of coriander with a yield of 39.3% and a density of 0.867 gr/ml. The average density produced is 0.8682 gr/ml.

TABLE 2. Experimental Results of The Mass Variable

No	Coriander mass (gram)	Oil mass (gram)	Oil volume (ml)	Yield (%)	Oil density (gr/ml)
1	30	11.7913	13.6	39.3043	0.8670
2	35	12.3035	14.2	35.1529	0.8664
3	40	12.3871	14.5	30.9678	0.8543
4	45	13.5404	15.3	30.0898	0.8850

FTIR Analysis

The linalool compound has an alcohol functional group (-OH), an alkene chain and an alkane chain as shown in the Figure 2.

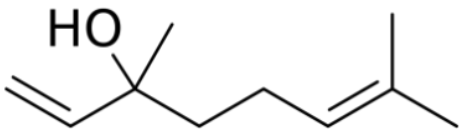

FIGURE 2. Chemical Structure of Linalool

The functional groups found in Linalool have been identified by comparing the vibrational frequencies in wavenumber of the spectrograph patterns obtained from the FTIR spectrophotometer with those on the IR correlation graph. Linalool's FTIR spectrum was carried out in the 4000 – 500 cm-1 spectral region. Figure 3 shows the results of the FTIR analysis for the linalool compound in the hexane solvent experiment. FTIR analysis showed that Linalool contained an (OH) group at 3316 cm-1. The wave number at 1641.12 cm^{-1} is associated with the C=C group, while at the wavelength 1409 cm^{-1} it indicates the presence of a (C-H) group. C–O band stretching is also seen at 1015 cm^{-1}

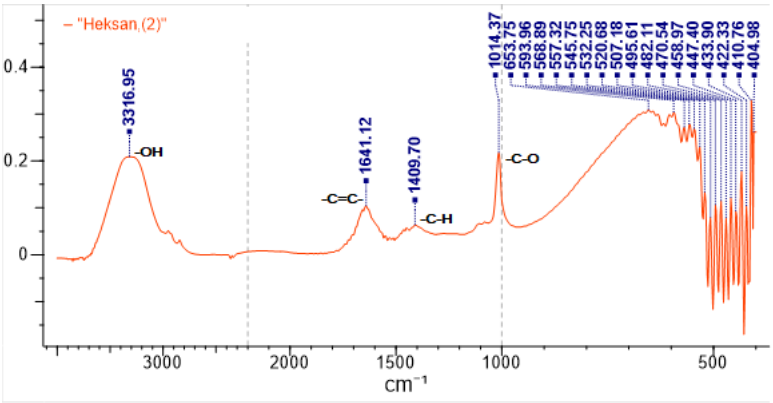

FIGURE 3. FTIR Analysis of Linalool Compound in Hexane Solvent

Figure 4 shows the results of the FTIR analysis for the linalool compound in the ethanol solvent experiment. FTIR analysis showed that Linalool contained an (OH) group at 3328 cm^{-1}. The wave number at 1641.12 cm^{-1} is associated with the C=C group, while at the wavelength of 1407.77 cm^{-1} it indicates the presence of a (C-H) group. The stretching of the C–O band is also seen at 1014.37 cm^{-1}

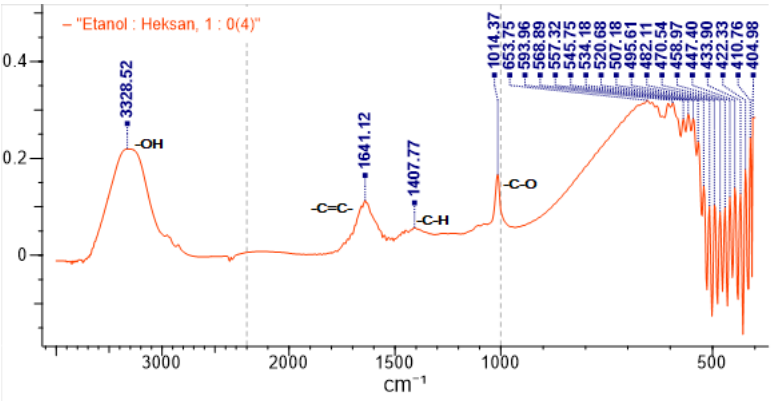

FIGURE 4. FTIR Analysis of Linalool Compound in Ethanol Solvent

Figure 5 shows the results of the FTIR analysis for the linalool compound in the ethanol-hexane solvent mixture experiment. FTIR analysis showed that Linalool contained an (OH) group at 3328.52 cm^{-1}. The wave number at 1641.12 cm^{-1} is associated with the C=C group, while at the wavelength of 1409.7 cm^{-1} it indicates the presence of a (C-H) group. The stretching of the C–O band is also seen at 1016.30 cm^{-1}

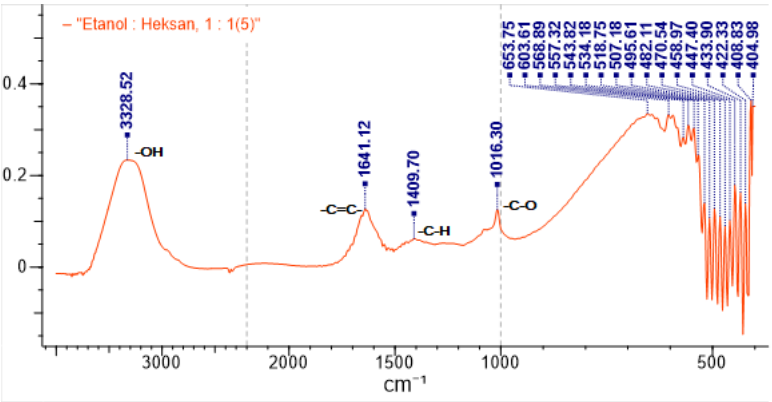

FIGURE 5. FTIR Analysis of Linalool Compounds in A Mixture of Ethanol-Hexane Solvents

CONCLUSION

Of the several solvent variables used, ethanol yielded the largest yield of 31.5253% with a density of 0.8867 gr/ml. While the mass variable that produces the largest yield is 30 grams of sample mass with a yield of 39.3% and a density of 0.8670 gr/ml.

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