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ISOLATION AND EXTRACTION OF EUGENOL FROM CLOVES - A REVIEW

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ABSTRACT

In this study was to obtain optimum conditions a reactive extraction process in isolation eugenol from clove essential oil associated with the temperature and time process. Natural Products are compounds that can be found or extracted in nature and usually produced by plants, animals, and/or fungi. Molecules originating in nature have long held in the importance in Chemistry. Essential oil and 0.8 N NaOH solutions at a ratio of 1:1.1 to the reactor. Turn on the hot plate and set the appropriate reaction temperature variables of the study and set the stirrer speed of 100 rpm. After a reaction time achieved according to the study variables (minutes) the reaction product was then separated. Distillate was eugenol and the residue was NaCl residual reaction products. Eugenol distillate which was then measured its volume and analyzed eugenol concentration by GC.

KEYWORDS: Clove Essential Oil, Eugenol, Reactive Extraction, Vacuum Distillation.

INTRODUCTION

Oil of cloves or eugenol is commonly used by dentists because it is antiseptic and anti-inflammatory. They often apply it to the gums to kill germs and relieve the pain of dental surgery such as tooth extractions, fillings, and root canals. Eugenol is a member of the phenylpropanoids class of chemical compounds. It is a Colourless to pale yellow, aromatic oily liquid extracted from certain essential oils especially from clove oil, nutmeg, cinnamon, basil and bay leaf. Essential oils are highly aromatic compounds extracted from a variety of botanical materials, including tree bark, flowers, stems, leaves, needles, plant roots, fruits and

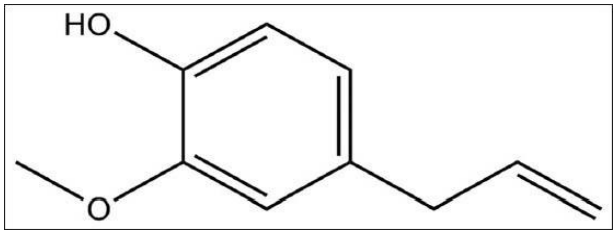
grasses. They are used in the production of perfumes, cosmetics, drinks, food flavoring, air fresheners, household cleaning products and aromatherapy oils. [1]

Clove essential oil was produced from the leaves, flowers and stems plant cloves with the extraction process. Potential autumn leaf clovers as raw materials essential oil of approximately 2,368,043 tons/year of 455/393 hactor of land area with a yield of 1- 4%.[2] Based on data from Agricultural Research and Development (2007) exports of Indonesian clove essential oil provides 60% of the world clove oil. A clove oil price in the world market is US $ 4.75/kg and the price of eugenol US $ 7.80/kg. From these data there is a considerable price difference between clove oil and eugenol. Although Indonesia is the largest clove oil exporter in the world, but the fulfillment of eugenol Indonesia still have to import from other countries.[3]

Eugenol is the main component in the essential oil of clove. Clove essential oil (Syzigium aromaticum L. Myrtaceae) were isolated by hidrodestilasi process, from the analysis of GC-MS has the composition of eugenol (88.58%), β-caryophyllene (1.39%), 2-heptanone (0.93%), ethyl hexanoate (0.66%), α-humulene (0.19%), calacorene (0.11%) and calamenene (0.10%)3. Essential oil of clove leaf (Syzigium caryophyllatum (L.) Alston) from Bangladesh were isolated by hidrodestilasi process, from the analysis of GC-MS has the composition of eugenol (74.3%), eucalyptol (5.8%), caryophyllene (3.85%) and α-cadinol (2.43%) (Elvianto Dwi Daryono 2015).

Oil of Wintergreen, an extract from the wintergreen group of plants, which contains 98% methyl salicylate, is a familiar fragrance and flavor associated with toothpaste and chewing gum. While we may relate a particular aroma with a single compound, the composition and aroma profile of essential oils is complex. Extracted oils are mixtures of varying concentrations of many compounds. In addition, essential oils are not oils in the conventional sense, that is, they are not long-chain hydrocarbon compounds, and their strong aroma does not always arise from the presence of an aromatic (phenyl) group in the oil's chemical composition.[3] the unusual nature of the reduction reaction to remove the oxygen functionality at C-9 has resisted elucidation, largely because of a lack of biochemical precedence. Moreover, the synthesis in plants of isomeric forms of the product of such a reaction, e.g., eugenol and isoeugenol, adds another layer of biochemical complexity. Some basil (Ocimum basilicum) varieties synthesize and accumulate eugenol, chavicol, or their methylated derivatives in the palate glandular trichomes (glands) on the surface of their

leaves.[1,13] In contrast, isoeugenol is one of three main volatiles emitted diurnally from the tube and corolla of the petunia (Petunia hybrida) flower.[14] Because of the relatively high level of production of these compounds in these species, and because they are amenable to laboratory manipulation, they were chosen as model organisms to investigate the production of these compounds in planta. Here we show that a basil enzyme belonging to the PIP family of NADPH-dependent reductases [named for the first three enzymes identified in the family, pinoresinol–lariciresinol reductase (PLR), isoflavone reductase (IFR), and phenylcoumaran benzylic ether reductase (PCBER)] catalyzes the formation of eugenol.(Takao Koeduka, 2006).



Structure of Eugenol

Chemical formula : $C_{10}H_{12}O_2$

Boiling point : 254 °C (489 °F; 527 K)

Acidity (Pk_a) : 10.19 at 25 °C

Melting point : −7.5 °C (18.5 °F; 265.6 K)

MATERIALS AND TOOLS

The main research material that clove essential oil purchased from Pune. Reagents used in the study include HCl (Sigma-Aldrich, 37%), potassium hydrogen palate (Sigma-Aldrich, 99%) and NaOH pellets (Riedel-de Haen, 99%). The reaction was performed on a laboratory scale using a three-neck round bottom. flask fitted condenser, thermometer and hot plate magnetic stirrer. The reaction temperature was maintained in accordance study variables using water

bath and atmospheric pressure. The separation of the reaction products was done by separating funnel. Then proceed purification of the reaction products using a set of distillation apparatus equipped with a vacuum pump.

Preparation

Clove essential oil that has prepared with analyzed eugenol concentration by GC. Creating 0.8 N NaOH solutions then standardized with potassium hydrogen palate. Assembling the reactor as a reaction consisting of a three-neck flask and condenser and to strengthen its position with the buffer and the stand. Then put the reactor on a magnetic stirrer hot plate. Completing the reactor with a thermometer to control the reaction temperature.

Reactive Extraction

Incorporating 100 ml clove essential oil and 0.8 N NaOH solution which has been standardized by a ratio of 1:1.1 to the reactor23. Turn on the hot plate and set the temperature at the reaction temperature rotation corresponding research variable (30, 40 and 50°C) and set the lap button magnetic stirrer at a speed of 100 rpm22mint. Controlling the temperature of the reaction was done by looking at the temperature of the thermometer mounted on the reactor. After a reaction time achieved according to the study variables (minutes) the reaction product was then inserted separating funnel and allowed to stand for 24 hours to form two layers. The bottom layer was Na-eugenolat (aqueous layer) and the top layer was organic layer. Separating the two layers and measuring the volume of the aqueous layer.

Vacuum Distillation

Na-eugenolat (aqueous layer) was then added 5 N HCl to obtain pH 4.21. Before placing Na-eugenolat distillation flask that has been mixed with HCl silenced while for NaCl precipitate formed, then the newly inserted distillation flask which had been fitted behind the cooler and thermometer. The mixture was then heated with a hot plate at a temperature of 195^{o}C and vacuum pressure of 6.10 Pka for 30 minutes. Distillate the eugenol and the residue was residual NaCl reaction products. Analysis Eugenol distillate which was then measured and analyzed of volume concentration of eugenol using gas chromatography (GC).

Alternative Isolation of Eugenol

If the eugenol does not separate from water after cooling, extract the aqueous layer with to 10 mL portions of dichloromethane. Combine the organic layers and dry them with sodium sulfate until the liquid is clear and the drying agent is not clumpy. Carefully transfer the

organic layer into an Erlenmeyer flask, making sure the solid stage behind. Using mild heat evaporate most of the dichloromethane until you have ~5 ml. Transfer that into a dried vials and evaporate the rest of the dichloromethane. Weigh the amount of eugenol you isolated, cap it, and turn it in to your TA in a properly labeled vial. (51LC-2012).

RESULTS AND DISCUSSION

The raw material was the essential oil of cloves eugenol its concentration was analyzed by GC and found concentrations of 25.261%. Yield of eugenol was calculated using the following equation:

[Volume of distillate X concentration of eugenol] end Yield (%) = [Volume of oil X concentration of eugenol] initial X 100.

Effect of Temperature and Reaction Time of Volume Aqueous Layer (Na-eugenolat). The bottom layer with the separation of the aqueous layer separating funnel which was Na-eugenolat reaction products between eugenol and NaOH. The higher the temperature and reaction time, the grater the volume of aqueous layer to obtain optimum conditions and Time Reactions to Yield of Eugenol (%) for the calculation of yield of eugenol measurable results isolated eugenol obtained. Visible optimum conditions were different in each study variable. At a reaction temperature of 30^{o}C variable has not been achieved the optimum conditions because the yield of eugenol still increase with the highest yield.

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REFERENCES

1. Elvianto Dwi Daryono /Int.J. Chemtech Res., 2015; 8(11): 564-569.
2. Bustaman S. 2011. Potensi pengembangan minyak daun cengkeh sebagai komoditas ekspor Maluku. Jurnal Litbang Pertanian, 2011; 30: 132-139.
3. Towaha J. The Benefits of Cloves Eugenol in Various Industries in Indonesia. Perspektif, 2012; 11: 7990.
4. Chaieb K, Hajlaoui H, Zmantar T, Kahla-Nakbi AB, Rouabhia M, Mahdouani K, Bakhrouf A. The chemical composition and biological activity of clove essential oil,

Eugenia caryophyllata (Syzigium aromaticum L. Myrtaceae): A short review. Phytother. Res., 2007; 21: 501-507.

5. Hamed SF, Sadek Z, Edris A. Antioxidant and antimicrobial activities of clove bud essential oil and eugenol nanoparticles in alcohol – free microemulsion. J. Oleo Sci., 2012, 61: 641-648.
6. Sudarma IM, Yuanita E, Suana IW. Markovnikov addition of chlorosulfuric acid to eugenol isolated from clove oil. Indo. J. Chem., 2013, 13: 181-184.
7. Ngadiwiyana, Ismiyarto, Jumino, Anwar C. Sintesis 3-(3,4-dimetoksifenil)-propanal sebagai senyawa antara dalam pembuatan turunan antibiotik C-9154 dari minyak daun cengkeh. JSKA, 2008; 11.
8. Medicinal Spices Exhibit. Vanilla, 2010.
9. Bilton P. Vanilla: history, extract, essence, syntetic vanilla and vanillism, 2011.
10. Free Press Release. Vanilla bean-artificial vanilla bean extracts, 2012. 13. Rasasti D. Oksidasi eugenol asetat dan uji aktivitas antioksidan senyawa turunannya.. Bandung: UPI. 2006.
11. Https://en.wikipedia.org/wiki/Eugeno
12. Moinuddin, S. G., Hishiyama, S., Cho, M. H., Davin, L. B. & Lewis, N. G. Org. Biomol. Chem., 2003; 1: 2307–2313.
13. Krauze-Baranowska, M., Mardarowicz, M., Wiwart, M., Poblocka, L. & Dynowska, M. Z. Naturforsch., C., 2002; 57: 478–482.
14. Ahmed, M., Amin, S., Islam, M., Takahashi, M., Okuyama, E. & Hossain, C. F. Pharmazie, 2000; 55: 314–316.
15. Karapinar, M. Int. J. Food Microbiol, 1990; 10: 193–200.
16. Moleyar, V. & Narasimham, P. Int. J. Food Microbiol, 1992; 16: 337–342.
17. Sangwan, N., Vermin, B., Verma, K. & Dhindsa, K. Pestic. Sci., 1990; 28: 331–335.
18. Raguso, R. A., Light, D. M. & Pichersky, E. J. Chem. Ecol, 1996; 22: 1735–1766.
    Gang, D. R., Dinkova-Kostova, A. T., Davin, L. B. & Lewis, N. G. inphytochemical Pest Control Agents, ed. Hedin, P. (Am. Chem. Soc., Washington, DC), 1997; 58–89.
19. Wang, J., Dudareva, N., Bhakta, S., Raguso, R. A. & Pichersky, E. plantphysiol, 1997; 114: 213–221.
20. Gershenzon, J., mccaskill, D., Rajaonarivony, J. I., Mihaliak, C., Karp, F. & Croteau, R. Anal. Biochem, 1992; 200: 130–138.
21. Dudareva, N., D'Auria, J. C., Nam, K. H., Raguso, R. A. & Pichersky, E. Plant J., 1998; 14: 297–304.

22. St-Pierre, B. & De Luca, V. in Recent Advances in Phytochemistry Evolution of Metabolic Pathways, eds. John, R. I., Romeo, T., Varin, L. & deluca, V. (Elsevier Science, Oxford), 2000; 285–315.