IOSR Journal of Applied Chemistry (IOSR-JAC)
e-ISSN: 2278-5736.Volume 11, Issue 7 Ver. I (July. 2018), PP 81-83
www.iosrjournals.org

The New Procedure of Isolation a Lycopene Compound in Tomatoes (Lycopersicum Esculentum) By Using Chloroform Solutions

Earlyna Sinthia Dewi
Agricultural Technology Study Program, Muhammadiyah Mataram University, Indonesia

***Abstract**: Lycopene is a pigment that causes red color in tomatoes. This research successfully isolated lycopene by using chloroform solvent followed by antisolvent crystallization. The samples used were ripe tomato juice. Lycopene extract was obtained through extraction method at 65ºC. Crystallization was performed by addition of methanol as antisolvent in lycopene extract under supersaturated conditions. From result of research by using chloroform solvent, the total lycopene content is 4.87 mg / 100 g. The functional group analysis using Fourier Transform Infra Red (FT-IR) spectroscopy detected C = C group at wavelength 1648,47 cm^{-1}, CH_2 group was detected at 1463,03 cm^{-1}, R-CH = CH-R detected at a wavelength of 959.24 cm-1. While the C-C and C-CH groups were detected at wavelengths of 1170.95 cm^{-1} and 1378.08 $cm^{-1.}$*

***Keywords**: Isolation, Lycopene, Lycopersicum esculentum*

Date of Submission: 29-06-2018 Date of acceptance: 16-07-2018

I. Introduction

Tomato (Lycopersicum esculentum) is a horticultural plant that is often used as vegetables, fruits, supplements of cooking spices, fresh drinks, sources of vitamins and minerals, and natural dyes. Chemically, the properties of a plant are related to their chemical content. Chemical content of tomatoes include, alkaloid solanine, saponins, folic acid, flavonoids and tannins. The most abundant carotenoid group in tomatoes is likopen which is equal to 63,6% [1].

Lycopene is a dark yellow to dark red pigment which is responsible for the red color in tomatoes. There are many benefits of lycopene compounds such as anti skin aging, prevent cardiovascular disease, diabetes, osteoporosis, infertility, and cancer, especially prostate cancer [2]. One of the way to get lycopene compounds is by isolation. Isolation of chemical compounds is an attempt to separate the mixed compounds so as to produce a pure single compound.

Based on the research that has been done, [3] has isolated lycopene from tomato sauce by liquid solid extraction method and crystallization using mixed solvent of methanol and carbon tetrachloride resulting 2,313 mg / 100 g tomato sauce extraction yield. [4] succeeded in extraction with sokhlet and antisolvent method with hexane, ethyl acetate and ethanol solvent, with yield of ethyl acetate extraction: 4.39 ± 0.27 mg / g, Hexane: 3.38 ± 0.38 mg / g , Ethanol: 1.25 ± 0.29 mg / g.

Based on the result of the research, it is seen that the isolated lycopene compound has very small content. In this case, it is necessary to optimize the isolation procedure to obtain higher lycopene compound content.

II. Theory

Tomatoes and tomato products are rich sources of vitamins C and A, lycopene, β - carotene, lutein, lectin, and various phenolic compounds such as flavonoids and phenolic acids. They are rich in folate, potassium, fiber, and protein, but low in fat and calories, and cholesterol-free [5]. In epidemiological studies, it has been shown that consumption of raw tomatoes and tomato-based products is associated with a reduced risk of cancer and cardiovascular disease [6].

The maturity level of tomatoes affects the lycopene content produced, the young green tomato contains lycopene about 25 ug / 100 g fresh weight, yellowish tomatoes 370 ug / 100 g (fresh weight, red tomato 4600 ug / 100 g fresh weight, and tomato pass mature contains lycopene about 7050 ug / 100 g fresh weight [7] .The tomato skin is dried in the sun, containing crude protein of 13.8 g / 100 g of dry matter, lycopene 112 mg / 100 g dry matter [8].

Tomatoes contain lycopene which is a group of carotenoids such as beta-carotene which is responsible for the red color in tomatoes. Lycopene can protect the body from diseases such as prostate cancer as well as some other types of cancer and coronary heart disease. The ability of lycopene in suppressing single oxygen is

twice as good as beta carotene and ten times better than alpha-tocopherol. Lycopene is an aliphatic hydrocarbon containing thirteen double bonds with the $C_{40}H_{56}$ molecular formula and has a molecular weight of 536.85 g / mol. There are 11 conjugated double bonds that are linier arranged to make lycopene longer than other carotenoids. Lycopene is more soluble in chloroform, benzene, and other organic solvents than in water. The solubility of lycopene in the oil is about 0.2 g / L at room temperature [5].

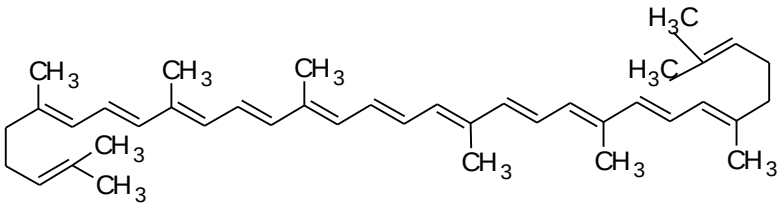

Figure 1. Lycopene structure

Lycopene is a soluble non-polar compound in chloroform, hexane, benzene, ethyl acetate, acetone, petrolium ether and other non-polar solvents [9]. The solvent used in this study was chloroform. Methods in this study were extraction using reflux and tomato juice. In reflux there is warming of mixture of simplicia and solvent in a round bottom flask. The solvent condenses with the coolant in the condenser through which the solvent vapor passes [10].

III. Research Method

The materials used in this study were ripe Tomato juice, chloroform ($CHCl_3$), methanol (CH_3OH), and aquadest. The tools used in this study include round bottom flask, reflux, condenser, stative and clamp, thermometer, analytical balance, separating funnel, measuring cup, blender, and Fourier Transform Infra Red Spectroscopy (FTIR).

Raw Material Preparation

Tomatoes washed with water till clean, then tomato is cut and removed the seeds and then mashed using a blender. tomatoes that have been mashed then stored in the chiller until it is used.

Extraction

Weighed 100 grams of tomato juice, then the sample was extracted for 3 hours with chloroform solvent with the solvent ratio (1: 3) at 65 ^oC. The extracts and raffinate obtained are washed with aquadest then inserted into separating funnel to separate extract and raffinate. The extract was washed with aquadest while shaken to separate the extract with its impurities. After 2 layers are formed, take all nonpolar layers and then put into a beaker glass.

Crystallization with Antisolvent

All nonpolar layers placed into the beaker glass are added 100 ml of methanol as antisolvent and then allowed to stand for a few hours until crystals are formed. The formed crystals are then filtered using the Whattman No. 1 filter paper after it is weighed by the crystal mass obtained.

IV. Results And Discussion

Result of characterization of FTIR (Fourier Transform Infra Red) extract of lycopene from tomato with addition of methanol as antisolvent, aim to identify functional group of likopen compound. The result of FTIR ((Fourier Transform Infra Red) can be seen in figure 2.

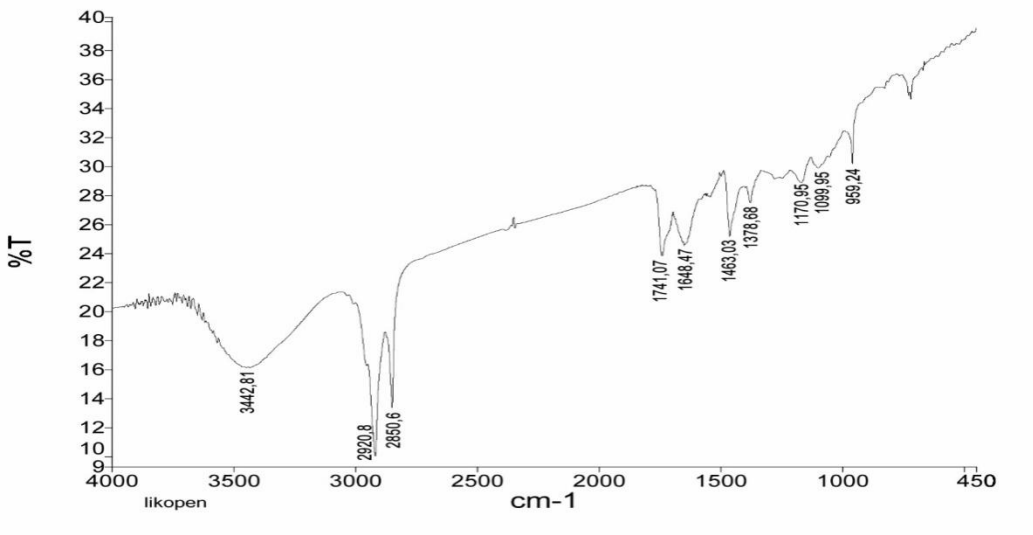

Figure 2 : Characterization FTIR (*Fourier Transform Infra Red*) Lycopene crystals

Figure 2 shows functional groups analysis result on lycopene crystal from tomatoes extract through FTIR spectroscopy performance that showed that lycopene had C=C double bond at 1648.47 cm^{-1} wave length. There was lycopene CH_2 symmetrical functional groups at 1463.03 cm^{-1}. On OH range groups occur at 3442.81 cm^{-1} wave length that enable steam included into lycopene. R-CH-CH-R groups on lycopene had 959.24 cm-1 wave length absorption. Meanwhile C-H bent group on lycopene situated at 1463.03 cm^{-1} wave length. C-C and C-C-H stretch groups respectively occur at 1170.95 and 1378.08 cm^{-1} wave length. C-O stretch group had 1170.95 cm^{-1} wave length.

Therefore, from the analysis of FTIR (Fourier Transform Infra Red) it can be concluded that the resulting lycopene has the expected clusters.

V. Conclusion

Based on the results of research and FTIR (Fourier Transform Infra Red) analysis it can be concluded to obtain higher lycopene content, it is necessary to perform new procedure in isolation of lycopene one of them by using chloroform solvent and the result obtained is 4.87 mg / 100 g.

References

[1]. Tadmor,Y et al. 2005 .Comparative Fruit Colouration in Watermelon and Tomato. J.Food Research International..38: 837–841.
[2]. V.Selvan Kalai, Vijayakumar, K.Suresh Kumar, Gyanedra dan Nath Singh, Lycopene's Effects on Health and Diseases, A Comprehensive Review Of Literature, 3 (3), 2011.
[3]. Aghel, N., Ramezani Z dan Amir Fakhrian S. 2011 "Isolation and Quantification of Lycopene From Tomato Cultivater in Dezfoul, Iran", Jundishapur Journal of Natural Pharmaceutical Products, 6(1), 9-15.
[4]. Myong Roh, Kyun, Min Hee Jeon, Jin Nam Moon, Woi Sook Moon, Sun Mee Park dan Jae Suk Choi, A Simple Method For The Isolation of Lycopene from Lycopersicon Esculentum, Botanical Sciences, 91 (2), 187-192, 2013
[5]. Preedy, V.R. and Ronald, R.W. 2008. Lycopene: Nutritional, Medicinal and Therapeutic Properties. USA : Science Publishers, Enfield, NH.
[6]. Rao, V. A. dan Agarwal, S. 2000, Role of Antioidant Lycopene in Cancer and Heart Disease, J. American College of Nutrition, 19(5): 563-569.
[7]. Fraser, P. D., M. R. Truesdale, C. R. Bird, W. Schurch, P. M. Bramley. 1994. Carotenoid Biosynthesis during Tomato Fruit Development. Plant Physiology Journal. 105 : 405-413.
[8]. Benakmoum A, Larid R, and Zidani S. 2013. Enriching egg yolk with carotenoids & phenols. World Academy of Science, Engineering and Technology.International Journal of Nutrition and Food Engineering, vol:7,No:7: 489-493
[9]. John Shi dan Marc Le Maquer, Lycopene in Tomatoes : Chemical and Physical Properties Affected By Food Processing, Critical Reviews in Food Science and Nutrition, Southern Crop Protection and Food Research Center Agriculture and Agri-Food, Canada, 2000
[10]. Hakim, A. 2016. Meningkatkan Kualitas Pembelajaran Kimia Bahan Alam Melalui Praktikum, Arga Puji Press, Mataram.

Earlyna Sinthia Dewi "The New Procedure of Isolation a Lycopene Compound in Tomatoes (Lycopersicum Esculentum) By Using Chloroform Solutions." IOSR Journal of Applied Chemistry (IOSR-JAC) 11.7 (2018): 81-83.