



ANALYSIS OF ALPHA LIPOIC ACID IN TOMATOES (*SOLANUM LYCOPERSICUM*) AS A SOURCE OF ANTIOXIDANTS FOR THE HUMAN BODY

Agung Dewantara, Rahmi Eka Witri^a, Vadianda Bastian^b, Dewi Maulida^c

Magister Programme of Biochemistry, Postgraduate, Universitas De La Salle, Philippines

^aMagister Programme of Educational Chemistry, Postgraduate, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Air Tawar Barat, Padang Utara, West Sumatera, Indonesia. 25171 Indonesia

^bDepartment of Chemistry, Faculty of Mathematics and Natural Science, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Air Tawar Barat, Padang Utara, West Sumatera, Indonesia. 25171 Indonesia

^cDepartment of veterinary medicine, Faculty of veterinary medicine (FKO), Universitas Brawijaya, Malang, Indonesia

*Corresponding email: rahmiswee3@gmail.com

ABSTRACT

Tomato (*Solanum Lycopersicum*) is a horticultural product that has the potential, health and has promising market prospects. Tomato contain a carotenoid compound called lycopene. tomato red. This carotenoid compound is well known as a compound that has high antioxidant power, this compound is able to fight free radicals caused by pollution and UV radiation. Alpha lipoic acid (ALA) is an antioxidant compound that is able to bind free radicals and regenerate antioxidants vitamin C, vitamin E, and coenzyme Q 10

Keywords: *Solanum Lycopersicum*, Alpha Lipoic Acid, antioxidant

1. INTRODUCTION

Tomato fruit (*Solanum Lycopersicum*) is a typical American fruit, consisting of various shapes and dimensions. Tomato is classified as a fruit because it is the edible part of the plant, which contains seeds or seeds, while vegetables are the edible parts of the leaves, roots and stems of plants [1]

The main pigments in tomatoes are lycopene and carotene. In the formation of lycopene, temperature has an important role, if the temperature rises, more lycopene will be formed [2, 3].

Tomatoes have various vitamins and anti-disease compounds that are good for health, especially lycopene. Tomatoes are low in fat and calories, are cholesterol free, and are a good source of fiber and protein. In addition, tomatoes are rich in vitamins A and C, beta-carotene, potassium, lycopene and Alpha Lipoic Acid (ALA) which are known as super antioxidants that can protect the body from various diseases. ALA is an antioxidant that is naturally produced by the body. In addition, ALA can also be obtained from various foods, both plant and animal foods [4, 5].

2. LITERATURE REVIEW

Tomato (*Solanum lycopersicum* syn. *Lycopersicon esculentum*) is a plant from the Solanaceae family, native to Central and South America, from Mexico to Peru [6]. Tomatoes are short life cycle plants, can grow to a height of 1 to 3 meters. This plant has green, yellow, and red fruits which are commonly used as vegetables in cooking or eaten directly without being processed [7]. Tomatoes have stems and leaves that cannot be consumed because they are in the same family as potatoes and eggplant, which contain alkaloids.[8]

Free radicals are atoms or molecules that are unstable and highly reactive because they contain one or more unpaired electrons in their outermost orbital [9]. To achieve atomic or molecular stability, free radicals will react with surrounding molecules to gain electron pairs. This reaction will take place continuously in the body and if not stopped will cause various diseases such as cancer, heart disease, cataracts, premature aging, and other degenerative diseases. Therefore, the body needs an important substance, namely antioxidants that are able to capture these free radicals so that they cannot induce a disease [10].

Lycopene or often referred to as β -carotene is a bright red pigment carotenoid found in tomatoes and other red fruits [11]. Lycopene is a carotenoid that is needed by the body and is one of the most powerful antioxidants [Its ability to control free radicals is 100 times more efficient than vitamin E or 12500 times than glutathione[12]. Apart from being anti-skin aging, lycopene also has benefits for preventing cardiovascular disease, diabetes, osteoporosis, infertility, and cancer, especially prostate cancer [13] .

Alpha-lipoic acid or alpha-lipoic acid is an antioxidant supplement that can be used to treat pain due to diabetic neuropathy [14]. This supplement is also believed to be able to lower bad cholesterol levels and lose weight in obese people [15, 16].

Alpha-lipoic acid is believed to be able to prevent cell damage, maintain a balance of vitamin E and vitamin C levels, and improve nerve cell function in diabetics [17, 18]. Apart from supplements, alpha-lipoic acid (ALA) can be obtained from foods, such as yeast, offal, carrots, tomatoes, spinach, broccoli, and beets. [19, 20]

3. EXPERIMENTAL

This study uses the literature review method or the SLR (systematic literature review) approach to examine research, assess and interpret and gather information about the compounds contained in tomato (*Solanum lycopersicum*) [21, 22, 23, 24] .

The research implementation aims to utilize local plants as medicine in curing diseases. This is a descriptive observational study conducted in an objective way looking backward (retrospectively). Where the plants are taken is tomato (*Solanum lycopersicum*) [25]. Furthermore, the plant was researched at Dr. Duke's Phytochemical and Ethnobotanical Database with the scientific name tomato (*Solanum lycopersicum*).

4. RESULTS AND DISCUSSION

Antioxidants function as compounds that can inhibit free radical reactions that cause carcinogenic, cardiovascular and aging diseases in the human body. Antioxidants are needed because the human body does not have an adequate antioxidant defense system, so if there is excessive exposure to radicals, the body needs exogenous antioxidants (derived from outside). food, prolong the service life in the food industry, improve the stability of the fat contained in food and prevent loss of sensory and nutritional qualities [26].

Vegetable food is an important food ingredient to obtain phytonutrients, one of which is tomatoes. Tomatoes are vegetables that are rich in various antioxidant compounds such as lycopene, alpha-carotene, beta-carotene, lutein, vitamin C, flavonoids, and vitamin E [27]. These carotenoid compounds have different effectiveness in carrying out their functions as photochemical protectors [28]. Of all these carotenoid compounds, lycopene is relatively more efficient as a singlet oxygen scavenger than other carotenoids (higher than A-carotene and B-tocopherol) [29]. Lycopene has the ability to capture singlet oxygen (nonradical ROS) which is twice that of α -carotene [30].

The plant was researched at Dr. Duke's Phytochemical and Ethnobotanical Database with the scientific name tomato (*Solanum lycopersicum*), the search was aimed at seeing the chemical in it, where the author took tomato (*Solanum lycopersicum*) and got the chemical Lycopene 20 ppm with deviation standard -0,96872.

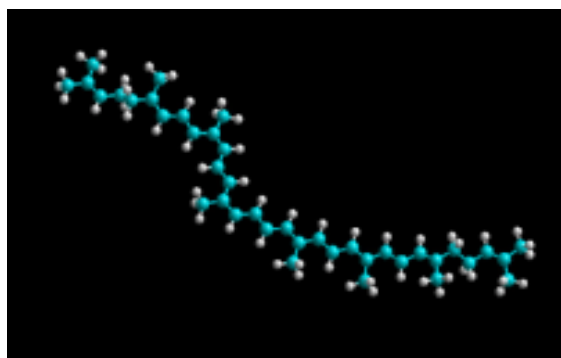


Figure1. 3D Structure of Lycopene

Source : Courtesy of Susanti [31]

And the content of Alpha lipid Acid (ALA) in 1 medium sized tomato (123 grams) reaches 3 mcg.

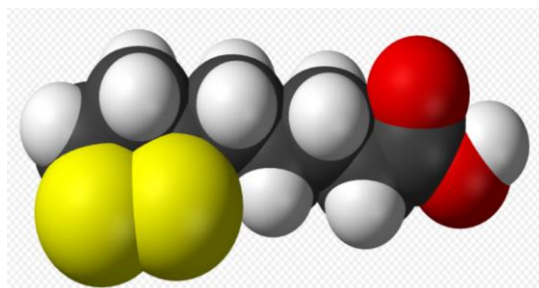


Figure1. 3D Structure of Alpha Lipoic Acid

Source : Courtesy of Wikipedia

5. CONCLUSION

Based on descriptive results and data analysis of tomato plants (*Solanum lycopersicum* syn. *Lycopersicum esculentum*). The lycopene content in tomatoes is 20 ppm with a standard deviation of -0.96872. The content of Alpha Lipoic Acid (ALA) in 1 medium size tomato (123 grams) reaches 3 mcg.

REFERENCES

- [1] Nasir, N., Armaleni, A., & Agustien, A. (2019). Antagonist of indogenous *Pseudomonas* fluorescent against *Ralstonia solanacearum* in tomato (*Lycopersicum esculentum*). *Metamorfosa: Journal of Biological Sciences*. Jin, L., Chen, D., Hirachan, S., Bhandari, A., & Huang, Q. (2022). SEC61G regulates breast cancer cell proliferation and metastasis by affecting the Epithelial-Mesenchymal Transition. *Journal of Cancer*, 13(3), 831-846.
- [2] Minh, N. P., Vo, T. T., Trong, T. N., Van Son, D., Chau, L. N., & Ha, N. T. (2019). Application of Ultrasound for Lycopene and Beta-Caroten Extraction in Gac Fruit *Momordica Cochinchinensis* Spreng. *Journal of Pharmaceutical Sciences and Research*, 11(3), 996-1000.
- [3] Styawan, A. A., Hidayati, N., & Susanti, P. (2019). Penetapan Kadar β -Karoten pada Wortel (*Daucus carota*, L) Mentah dan Wortel Rebus dengan Spektrofotometri Visibel. *Jurnal Farmasi Sains dan Praktis*, 5(1), 7-13.
- [4] Ren, F., Feng, T., Dai, G., Wang, Y., Zhu, H., & Hu, J. (2018). Lycopene and alpha-lipoic acid improve semen antioxidant enzymes activity and cashmere goat sperm function after cryopreservation. *Cryobiology*, 84, 27-32.
- [5] Tibullo, D., Li Volti, G., Giallongo, C., Grasso, S., Tomassoni, D., Anfuso, C. D., ... & Bramanti, V. (2017). Biochemical and clinical relevance of alpha lipoic acid: antioxidant and anti-inflammatory activity, molecular pathways and therapeutic potential. *Inflammation Research*, 66(11), 947-959.
- [6] McGhie, T. K., & Cordiner, S. B. (2021). Carotenoid and polyphenol content of heritage tomatoes.
- [7] Ristic, D., Vucurovic, A., Petrovic, B., Krstic, B., Stankovic, I., Vucurovic, I., & Zecevic, K. (2021). Pepino mosaic virus, a new threat for Serbia's tomatoes. *Spanish Journal of Agricultural Research*.

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- [8] Kamble, S. H., Sharma, A., King, T. I., León, F., McCurdy, C. R., & Avery, B. A. (2019). Metabolite profiling and identification of enzymes responsible for the metabolism of mitragynine, the major alkaloid of *Mitragyna speciosa* (kratom). *Xenobiotica*, 49(11), 1279-1288.
- [9] Suryanto, E., & Wehantouw, F. (2019). Aktivitas penangkap radikal bebas dari ekstrak fenolik daun sukun (*Artocarpus altilis* F.). *Chemistry Progress*, 2(1), 1-7.
- [10] Arifin, B., & Ibrahim, S. (2018). Struktur, bioaktivitas dan antioksidan flavonoid. *Jurnal Zarah*, 6(1), 21-29.
- [11] Caseiro, M., Ascenso, A., Costa, A., Creagh-Flynn, J., Johnson, M., & Simões, S. (2020). Lycopene in human health. *LWT*, 127, 109323.
- [12] Hausladen, A., & Alscher, R. G. (2017). Glutathione. In *Antioxidants in higher plants* (pp. 1-30). CRC Press.
- [13] Chu, E., & Sartorelli, A. C. (2018). Cancer chemotherapy. *Lange's Basic and Clinical Pharmacology*, 948-976.
- [14] Di Tucci, C., Di Felicianantonio, M., Vena, F., Capone, C., Schiavi, M. C., Pietrangeli, D., ... & Benedetti Panici, P. (2018). Alpha lipoic acid in obstetrics and gynecology. *Gynecological Endocrinology*, 34(9), 729-733.
- [15] Marlow, B., Kuenze, G., Li, B., Sanders, C. R., & Meiler, J. (2021). Structural determinants of cholesterol recognition in helical integral membrane proteins. *Biophysical Journal*, 120(9), 1592-1604.
- [16] Karimi Aliabadi, P., Bahar, A., Nabati, M., & Sohrab, M. (2021). A Brief Overview of the Latest Treatment Guidelines for Lipid Disorders in Primary Prevention of Cardiovascular Disease in Adults. *Journal of Mazandaran University of Medical Sciences*, 31(202), 168-178.
- [17] Setiowati, R. D., Yenni, Y., Panjaitan, F. R., Sujadi, S., Lubis, M. I., & Ernayunita, E. (2021). Preliminary Study of Vitamin E Content in IOPRI'S Oil Palm Varieties. *Jurnal Penelitian Kelapa Sawit*, 29(3), 159-166.
- [18] Velazco, D. (2021). Enhancement of Dry-Aged Beef Quality by Dietary Supplementation of High Levels of Vitamin E.
- [19] El Barky, A. R., Hussein, S. A., & Mohamed, T. M. (2017). The potent antioxidant alpha lipoic acid. *J. Plant Chem. Ecophysiol*, 2, 1016.
- [20] Saruhan Guler, N., Ozturk, K., Sezgin, A., Altuntas, C., Kadioglu, A., & Terzi, R. (2021). Alpha Lipoic Acid Application Promotes Water-Deficit Tolerance by Modulating Osmoprotectant Metabolism-Related Genes in Maize. *Russian Journal of Plant Physiology*, 68(6), 1152-1160.
- [21] Putri, D. F., Ritonga, H. M., Murdiati, V., & Zainul, R. (2018). A REVIEW WHAT IS HYDROTHERMAL?.
- [22] Candani, D., Ulfah, M., Noviana, W., & Zainul, R. (2018). A Review Pemanfaatan Teknologi Sonikasi.
- [23] Febriani, S. S., Yolanda, T., Arianti, V. A., & Zainul, R. (2018). A Review Solid Stated: Principles and Methode.
- [24] Dinata, A. A., Rosyadi, A. M., Hamid, S., & Zainul, R. (2018). A Review Chemical Vapor Deposition: Process And Application.
- [25] Kharisma, V. D., Agatha, A., Ansori, A. N. M., Widyananda, M. H., Rizky, W. C., Dings, T. G. A., ... & Zainul, R. (2022). Herbal combination from *Moringa oleifera* Lam. and *Curcuma longa* L. as SARS-CoV-2 antiviral via dual inhibitor pathway: A viroinformatics approach. *Journal of Pharmacy and Pharmacognosy Research*, 10(1), 138-146.
- [26] Candani, D., Ulfah, M., Noviana, W., & Zainul, R. (2018). A Review Pemanfaatan Teknologi Sonikasi.
- [27] Zainul, R. (2016). Isolation and identification of freshwater microalgae potentially as antibacterial from Talago Biru, Koto Baru, West Sumatera. *Der Pharmacia Lettre*, 8(20), 157-165.
- [28] Zainul, R. (2016). Isolation and molecular identification of freshwater microalgae in Maninjau Lake West Sumatra. *Der Pharmacia Lettre*, 8(20), 177-187.
- [29] Fadjria, N., & Zainul, R. (2018). Isolation and molecular identification of freshwater microalgae in maninjau lake west Sumatera.
- [30] Fadjria, N., & Zainul, R. (2018). Isolation and molecular identification of freshwater microalgae in maninjau lake west Sumatera.
- [31] Susanti, N. M. P., Saputra, D. P. D., Hendrayati, P. L., Parahyangan, I. P. D. N., & Amarawati, G. A. K. MOLECULAR DOCKING LIKOPEN SEBAGAI ANTIOSTEOPOROSIS SECARA IN SILICO. *Chimera*, 1, 1.
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