Research Journal of Recent Sciences _____ ISSN 2277-2502
Vol. 3**(IVC-2014),** 68-70 **(2014)** *Res. J. Recent. Sci.*

Isolation and Quantification of Lycopene from Watermelon, Tomato and Papaya

Neelu Malviya
Department of Chemistry, Govt. M.L.B. Girls P.G. College, Fort, Indore MP, INDIA

Available online at: www.isca.in, www.isca.me
Received 8th July 2014, revised 20th August 2014, accepted 17th September 2014

Abstract

Lycopene is one of the carotenoid naturally occurring in red fruits and vegetables, especially watermelon, tomato and papaya. It is an antioxidant and responsible for red colour of various fruits and vegetables. This studies to analyses the lycopene content from various fruits by a very simple process of lycopene isolation. Identification of lycopene and its chemical structure was done by chemical test, microscopic study and by using visible spectrophotometer. Quantity of isolated pure lycopene was recorded from papaya tomato and watermelon ranged from 1.14mg -3.18mg per 100 gm.

Keywords: Lycopene, antioxidant, papaya, watermelon, tomato..

Introduction

A modern life style keeps away people from healthy diet. For healthy dietary habits one should increase the consumption of food products which are helpful to the prevention of illness.

Fruits and vegetables are main source of natural antioxidant components. Antioxidants give protection against harmful free radicals and reduce rate of cancer and heart disease[1]. The most efficient carotenoid antioxidant is lycopene. Lycopene is a natural pigment which protects the body by neutralizing the negative effects of oxidants. In the synthesis of vitamin A lycopene plays an important role as an intermediate and carotenoid like β-carotene and β cryptoxenthin, influences its development[2].

Lycopene is soluble in fat and synthesized by plants and microorganisms. Regular intake of lycopene containing food reduces the risk of body tumor especially prostate cancer, studies have shown that the antioxidants vitamin E, selenium, and lycopene all reduces risk of prostate cancer. Therefore, it would say that lycopene is very important for cancer prevention, it also reduces LDL cholesterol and cardiovascular diseases. It is a carotenoid and gives red colour to vegetables and fruits. Lycopene in processed foods is mainly in the form of the isomers. Its molecular formula is C_{40} H_{56} and 536.88 is its molecular weight[3, 4].

Lycopene is highly unsaturated hydrocarbon with 13 double bonds, It has been reported that 11 unsaturated bonds are conjugated[5]. Conjugated bonds of lycopene molecule gives ability to act as an antioxidant and make it more efficient for the use of human health[6]. Natural food sources of lycopene are tomatoes, watermelon, pink guava, pink grapes, papaya and apricots[7].

Red flesh watermelon is the main food sources of Lycopene as the plentiful carotenoid [8]. Tomato is very rich and good source of lycopene. Papaya (Carica papaya) grown in tropical and sub-tropical environments. The presence of carotenoid pigments gives the colour to papaya fruit. Red-fleshed papaya fruit contain Lycopene[9].

Lycopene has been extracted from the several different fruits and berries[10, 11]. It was first isolated from Tamuscommunis by Harsten in 1873[12]. When consumption of lycopene from different products up to 150 mg daily shows no side effects[13]. Recent studies have shown that ingested lycopene is metabolized in the body. Several metabolites have now been identified and characterized[14].

Various researches show that lycopene can be used for the treatment of prosted cancer[15,16]. Lycopene has some more medicinal applications and if patients of cancer increase the quantity of tomato, watermelon and papaya in diet then it is more helpful to fight against disease[17].

In the present investigation the amount of lycopene isolated from watermelon, tomato and papaya has been recorded and quantification of lycopene was done by different methods.

Material and Methods

We studied three different fruits watermelon (*citrulluslanatus*), tomato (*Solanumlycopersicum*) and papaya (*carica papaya*). These were purchased from the local fruits and vegetable shop, ready for consumption and were transported to the laboratory, stored in refrigerator.

Isolation method: We made a paste separately of watermelon, tomato and papaya. In the laboratory weigh 100 gm. paste of each of the three fruits.

100 gm. of sample of watermelon taken in a 250 ml beaker. Then warm the paste and add about 30 ml of warm (40^0C) benzene to it. Stir well and decant the benzene layer. Again add 30 ml warm benzene, stir and decant the benzene. This has been done about 5 times. Then distil off benzene and we got residue of Lycopene. Recrystallized residue by ether and weighed[18].

Repeat the steps with other sample of tomato and papaya and recorded the observations. Identification test of the isolated Lycopene were performed using chemical tests and by microscopic study, identification of chemical structure was done using visible spectrophotometer.

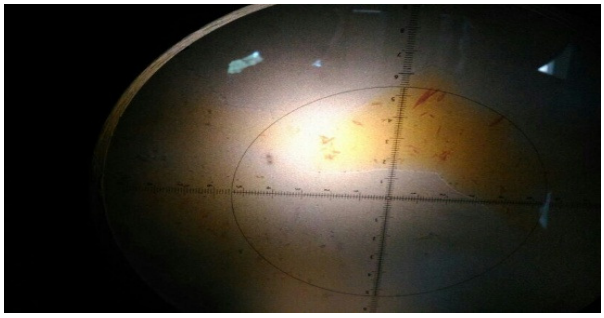
Result and Discussion

The yield of lycopene after recrystallization was shown in the table. All the samples give a significant difference in the lycopene content. Watermelon has a highest content i.e. 3.18 mg which is significantly more than tomato. Tomato and papaya have 2.72 mg and 1.14 mg lycopene content respectively Again both have a significantly different values. To identify the lycopene extracted, few crystals were dissolved in concentrated sulfuric acid and they impart a indigo blue colour to the solution as we add water to it, again turns to red colour.

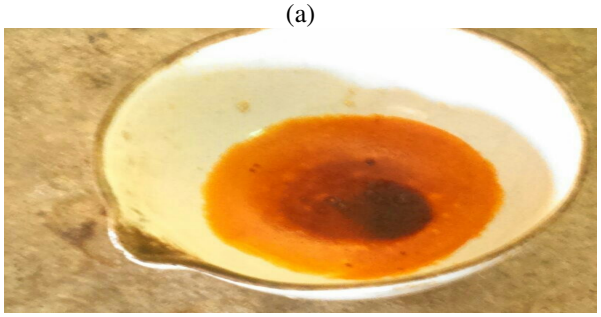
This test initially helps us to identify lycopene in the residue. A simple liquid-liquid extraction method was employed to extract lycopene in minimum organic solvent. Crystals were purified by recrystallization from ether. Obtained crystals were then observed under projection microscope.

We got coloured crystals shows that they were pure crystals of lycopene because literature tells that impurity gives colourless crystals[19].

For purity and structural analysis lycopene was investigated by UV-Visible spectrophotometer (double beam spectrophotometer model no 2375, Metzer).



(a)



(b)

Figure-1
(a) Crystals of extracted lycopene under microscope.
(b) Extracted lycopene

The maximum wavelengths are 432, 478 and 512nm, which is the maximum wavelengths of pure lycopene[20,21]. Chromatographic techniques andliquid liquid extraction methods can be use to pure lycopene.

Table-1
Lycopene content in different fruits

S. No.	Fruit	Weight(g)	Lycopene(mg/100g)
1	watermelon	100	3.18
2	tomato	100	2.72
3	papaya	100	1.14

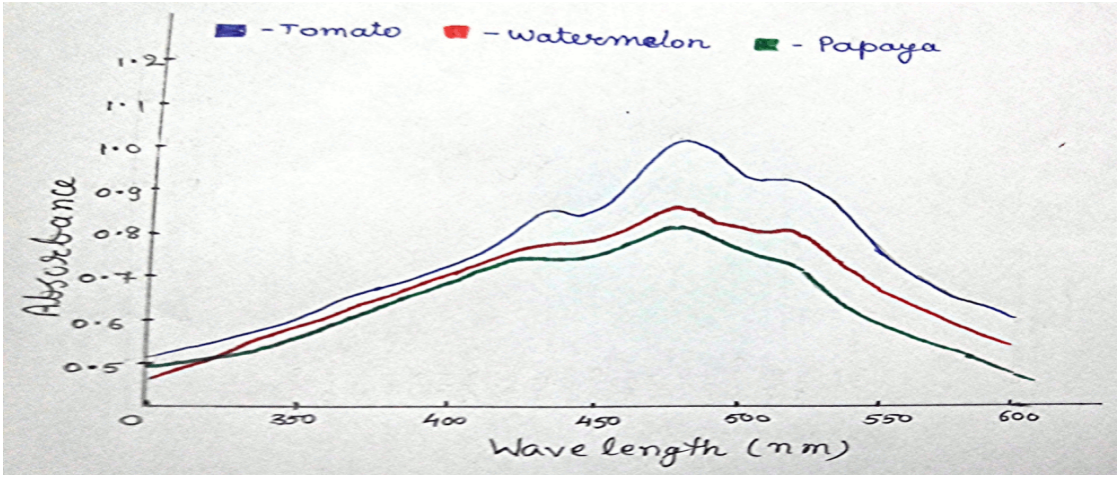


Figure-2
Visible spectrum of extracted lycopene

Conclusion

Results of the studies showed that the fruits analyzed having high concentration of Lycopene. In this study, the highest content of lycopene was observed in *citrulluslanatus* (watermelon). The second highest content was found in *Solanumlycopersicum* (tomato) and the lowest content was in *carica papaya* (papaya). As research shows that papaya presented best physicochemical properties but have low lycopene concentration then tomato and watermelon.

The results of studies can be improved when we use different solvents in extraction process. In the above discussed procedure benzene was used to extract lycopene from watermelon, tomato and papaya.

References

1. Luis Eduardo Ordonez-Santos, Dinna Patricia Ledezma-Realpe, Lycopene concentration and physic-chemical properties of Tropical fruits, *Food and Nutrition Science,* **4,** 758-762 **(2013)**

2. P.D. Fraser and P.M., Bramley, Review: The Biosynthesis and Nutritional Uses of Carotenoids, *Progress in Lipid Research,* **43(3),** 228-265 **(2004)**

3. M. Anese, G. Mirole, A. Fabbro and G. Lippe, Lycopene bioaccessibility and bioavailability from processed foods, *Journal of Scientific & Industrial Research,* **72,** 543-547 **(2013)**

4. Thet HtarOo, Extraction and Determination of Nutritional values and Lycopene from five different fruits**,** Yangon *University of Distance Education Research Journal,* **3(1),** 135-144 **(2011)**

5. Lticia G. Rao, EMMA Guns A Venket Rao, Lycopene – Its role in human health and diseases, AGRO food industry 25-30 **(2003)**

A. M. Basuny, A.M. Gaffar and S.M. Arafat, Tomato lycopene is a natural antioxidant and can alleviate hypercholesterolemia, *African Journal of Biotechnology,* **8(23)**, 6627-6633 **(2009)**

6. Alison J. Edwards et. al., Consumption in watermelon juce increases plasma concentration of Lycopene and β-carotenoid in humans, *The American Society for Nutritional Science* **(2003)**

7. Pinto M.P. et al., lycopene content and antioxidant capacity of portugues watermelon fruits, *EJEAF Che,* **10(4),** 2090-2097 **(2011)**

8. Luke C. Devitt, Kent Fanning, Ralf G. Dietzgen and Timothy A. Holton, Isolation and functional characterization of a Lycopene b-cyclase gene that controls fruit colour of papaya (carica papaya L.), Journal of Experimental Botany, 1-7 **(2009)**

9. Karrer P., Rubel F. and Strong F.M., Notizenuber Vorkommen von Carotinoiden in Pflanzen. Helv. Chim. Acta., **19,** 28 **(1936)**

10. Kuhn R., Bielig H., Dann O. and UberInvertseifen I., die Einwirkung Von Invertseifen auf Eiweiß-Stoffe. Chemische Berichte, **73,** 1080-91 **(1940)**

11. Ikan R., Ntural Products: A Laboratory Guide. 2nd Ed. Academic press, London, **(1991)**

12. Rao A.V. and Agarwal S., Nutrition and Cancer, **31,** 199 **(1998)**

13. Khachik F., Carvallo L., Bernstein P.S., Muir G.J., Zhao D.Y. and Katz N.B., Exp Biol Med (Maywood), 227 845 **(2002)**

14. Kucuk O., Sarkar F.H. and E.A. Sakr W., Cancer Epidemiol Biomarkers Prev, **10** 861 **(2001)**

15. Matlaga B.R., Hall M.C., Stindt D. and Torti F.M., *Journal of Urology,* **166,** 613 **(2001)**

16. Giovannucci E., *J National Cancer Institute,* **91,** 317 **(1999)**

17. Raj K. Bansal, Laboratory Manual of organic chemistry, 235 **(1994)**

18. Aghel N., Ramezani Z., Amirfakhrian S., Isolation and Quantification of lycopene from Tomato cultivated in Dezfoul, Iran, *Jundishapurjou of Natural Pharmacutical Products,* **6(1),** 9-15 **(2011)**

19. Naviglio D., Pizzolongo F., Ferrara L., Naviglio B., Aragon A. and Santini A., Extraction of pure lycopene from industrial tomato waste in water using the extractor Naviglio, *African J. Food. Sci.,* **2(2),** 37-44 **(2008)**

20. Monica V. Butnariu and Camelia V. Giuchici, The use of some nanoemulsions based on aqueous propolis and lycopene extract in the skin's protective mechanisms against UVA radiation, *J. of Nanobiotechnology,* **9,** 3 **(2011)**