

# A Review on Recent Techniques of Extraction and Isolation of Lycopene from Tomato

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## ABSTRACT

Lycopene is a natural pigment mainly responsible for the deep-red colour of tomato. Lycopene can be found in various natural products like tomato, red pepper, watermelon, and papaya. Due to its physicochemical and biological properties it attracts much attention towards it. Lycopene is only synthesized by plants. In preventing various diseases mainly degenerative diseases lycopene plays an important role. This article describes the various methods of extraction and isolation of lycopene.

**Keywords:** lycopene, tomato, methanol, hexane.

## INTRODUCTION

In the current span, tomatoes and its products have gained immense attention owing to the presence of lycopene, a carotenoid pigment, which holds the ability to control numerous ailments like cancer and other degenerative illnesses by hindering the activity of free radicals. *Solanum lycopersicum* is recognised as tomatoes which is useful for human consumption. Red fruit belongs to the nightshade family in which there are 3000 more species. There are some examples of nightshade family which are like potato, pepper, tobacco. Tomato is often appraised as a vegetable, has become popularly consumed food in India. Tomato can be consumed in multiple ways which includes sauce, drinks and salads etc. For nutritional benefits tomato is used mostly. Because of its growing dietary value and tremendous production as well as its use as a model plant

for diverse research tomatoes are considered as most elevated vegetable in global.

Tomato consumption in diet can protect and defend against cancer and reduce blood glucose in diabetic patients. Tomatoes have insistent valuables towards health. Tomatoes include bioactive compounds which have a wide range of physiological properties. It contains many health sympathetic or health advance compounds such as phenolic compounds, carotenoids, and vitamins which enact a powerful role with related to the fine fettle. It has economic as well as nutritional significance. Tomatoes contain most worthy phytochemicals which include polyphenols and carotenoids which recuperate some sensory qualities. For example like carotenoids like red pigmented lycopene,  $\beta$ -carotene, pro-vit A compound phytofluens, phytoene, extremely poistin raw tomatoes and in their products. With 98% flavonol arise enormous part of total flavonol contained in the skin as in assimilation forms of quercetin and kaempferol.

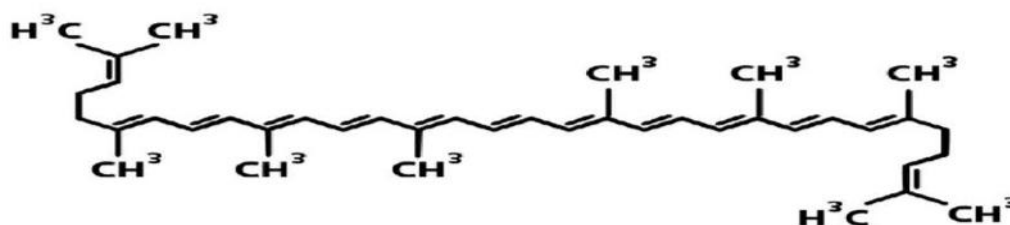
Tomatoes chiefly contain 94-96% water content is present and 4.5 to 9.5 % is solid matter and in the solid matter 1% is skin and seed. Solid percentage is present in tomatoes and at the back of this there are different cognitions present like soil characteristics, irrigation property etc. In tomato main part of soluble solid is free sugar and in this reduces sugar are predominant. In tomato juice there is insoluble solid present which ranges from

16-21% of all total solid which is composed of pectin and cellulose. In tomatoes there is presence of various acids in small aggregate in which Citric acid which acts as citric monohydrate is the main or dominant acid present in tomato.

### Lycopene

Fruits and vegetables are cardinal fountainhead of natural antioxidant components. Antioxidants offer security in opposition of noxious free radicals and reduce rate of cancer and heart disease. The greatest eligible carotenoid antioxidant is lycopene. Antioxidant potential of lycopene to delocalize free radical species localised in

the existence of conjugated carbon-carbon double bonds, which helps to make it quite advantageous for the human beings. Under an obligation to this, its demand is quite high in food, pharmaceutical industries and cosmetic industries. Tomatoes and its products like paste and pulp are estimated as one of the affluent sources of lycopene. The amount of lycopene in tomatoes fluctuates between 90 to 190  $\mu\text{g/g}$  fresh weight. Tomato paste is a dense converge made from the ripened tomatoes with the skin and seeds removed, while tomato pulp is not in the process form, pick up by moving the fresh raw fully red tomatoes from the fine pulper machine removing the seeds.



Remarkable aggregate of lycopene is available in the chromoplast of the plant tissues. In tomatoes, its biosynthesis travel on a quickly step during the ripening process, in which the chloroplast changes into chromoplast. Voluminous sheets of lycopene are exist in the outer part of the pericarp meanwhile the inner jelly like part largely contains beta-carotene.

### Structure of lycopene:-

Lycopene is an unsaturated acyclic hydrocarbon. It contains 13 double bonds, of which 11 are conjugated. The chemical name of lycopene is 2,6,10,14,19,23,27,31-octamethyl-2,6,8,10,12,14,16,18,20,22,24,26,30-dotriacontatriecaene. Common names include  $\Psi,\Psi$ -carotene, all-trans-lycopene, and (all-E)-lycopene. The chemical formula is  $\text{C}_{40}\text{H}_{56}$ .

Lycopene is a symmetrical tetraterpene assembled from 8 isoprene units. It is an associate of the carotenoid family of compounds, and because it

consists of carbon and hydrogen, it is called as a carotene. All-trans form, the molecule is long and straight, constrained by its system of eleven conjugated double bonds. Each double bond in this extended  $\pi$  electron system lower the energy essential for electrons to transition to elevated states, allowing the molecule to soak up apparent light of evolutionary longer wavelengths.

Under an obligation to the expedient consequences of lycopene, it needs time to reform its extraction methods. In the across, simply organic solvents merely such as hexane, ethyl acetate, benzene, ethyl ether, acetone, ethanol and petroleum ether etc were used to extract lycopene from its natural sources. Besides, different unification of solvents were used to accomplish the same motive in more powerful way. These solvents oneself or in aggregation were not effective in extracting greatest lycopene, as they do not have the ability to dissolve the cell wall constituents that is cellulose and pectin, mostly liable for the binding of lycopene.

The current observation was planned for the extraction of lycopene from raw tomato and tomato products paste and pulp. Extraction using ethanol - acetone - hexane, Extraction using hexane, Extraction using methanol, Extraction using acetone petroleum ether, Extraction using benzene.

## **MATERIALS AND METHODS OF EXTRACTION**

### **1] Extraction by using Ethanol - Acetone - Hexane :-**

Material - Tomato paste, Ethanol, acetone, hexane, shaker, aluminium foil

First of all we made a paste of tomato nearly about 100 gm. In this method three solvents were use such as (1) Acetone , (2) Ethanol , (3) Hexane which are used for comparison of extraction efficiency. With each solvents tomato paste were mixed or submitted in (1:10 v/v) ratio with the help of shaker for nearly about 30 minutes. The vessels were cover with aluminium foil for protection by light and this extraction was performed at room temperature. Further the lycopene were assayed for purity and concentration by using UV – V is spectroscopy at 472 nm ( absorption of lycopene at maximum)

### **2] Extraction by using Hexane :-**

Material - sample powder, beaker, BHT - acetone solution, hexane, magnetic stirrer plate, aluminium foil

0.3-0.6g powder ( sample) was weighed in a beaker, in that beaker 5ml BHT – acetone solution ( 0.05% w/v ) , 5 ml ethanol and 10 ml hexane were added . Now the beaker was placed in a bowl of ice on a magnetic stirring plate , stirred it at least 15 min and 3 ml distilled water were added to it. On ice upto 5 min it was shaken and for separation of both phases it was incubated at room temperature for 5-6 minutes. Two phases were separated. The upper layer which contains lycopene was isolated with the help of pipette and collected in a test tube. The tubes which contain lycopene extracts were covered with aluminium foil and further stored in the freezer until further analysis.

### **3] Extraction by using Methanol :-**

Material - tomato paste, methanol, benzene, microscope,

First of all 50 gm of tomato paste was dehydrated by adding 65 ml methanol in it. For the prevention of hard lumps this mixture was shaken vigorously and immediately. nearly after 2 hrs , the thick suspension present in mixture were filtered , the dark red cake obtained which was shaken for next 15 min with 75 ml mixture of equal volume of methanol and carbon tetrachloride and separated by filtration . The carbon tetrachloride phase was transferred to a separatory funnel by added one ml volume of water and shaken well. By this phase was separated and after phase separation , the carbon tetrachloride phase was evaporated and the residue was diluted with about 2 ml of benzene. By means of dropper 1 ml of boiling methanol was added in portion , and because of this the crystals of crude lycopene were appeared immediately and the crystallization was completed by keeping this liquid at room temperature and ice bath respectively. After this the crystals were washed 10 times by using benzene and boiling methanol. By observing under the microscope long and red lycopene prisms were observed with some colourless impurity substances. Because of this more purification is required which is done by using column chromatography on active acidic alumina by using toluene as eluent. The deep red zone was collected after complete of solvent, the residue was dissolved in 2 ml of benzene. After recrystallization by means of using boiling methanol, no colourless substances observed. Crystalline lycopene is not isomerized but has tendency to autoxidation, specially in light so it was kept in dark evacuated glass tubes which is prior to use.

### **4] Extraction by using Acetone-Petroleum Ether :-**

Material - sample, acetone - petroleum ether, pipette, micropipette, aq Potassium carbonate, calcium chloride, aluminium foil, freezer

In this method, sample (1.0-1.5 g powder ) was extracted by using 10 ml acetone –

petroleum ether ( 50% v/v). After this there is formation of layer in which the upper layer lycopene containing organic layer was removed with the help of pipette and collected in test tube. Extraction was repeated. Now the extracts were combined and washed with 15 ml saturated aqueous sodium chloride and removed the aqueous wash with a micropipette. The extract present was washed with 10ml of 10% aq.potassium carbonate (K<sub>2</sub>CO<sub>3</sub>) and removed the aqueous wash. By using drying agent like calcium chloride the lycopene containing organic layer was dried. Some of the excess solvent is present which is further allowed to evaporate at room temperature for few minutes in the dark. For further analysis the tubes containing lycopene extracts were covered with the aluminium foil and stored in freezer.

#### 5] Extraction by using Benzene:-

Material - Tomato paste, benzene, spectrophotometer

For this method we made a paste of tomato nearly about 100 gm which is weigh in laboratory. That 100 gm of sample paste of tomato was taken in 250 ml of beaker. After that, warm that paste and add about 30 ml of warm benzene (400°C) to it. Stir it well and pour out the benzene layer. Again add 30 ml warm benzene to it, stir it and pour out the benzene layer. This has been done about 5 times. Then distil off benzene and we got residue of Lycopene. After this recrystallized residue by ether and weighed. For the isolated lycopene some identification tests are requires which are performed by using chemical tests and microscopic study. Beside this identification of chemical structure is also important which is done by using visible spectrophotometer.

#### DISCUSSION

By using different types of methods the extraction and isolation of lycopene carried out. When we use hexane for extraction then it gives some characteristic peaks which are similar to some

characteristic peaks provided by the extracted lycopene in acetone. It was specified the acetone contain lower toxicity can be used as lycopene extracting solvent. Benzene test helps us for the identification of lycopene in residue. In comparison of hexane extraction with acetone-petroleum ether extraction, acetone-petroleum ether gives higher crude lycopene yield.

#### CONCLUSION

By results of studies it express that the fruit analyzed contains high concentration of Lycopene. In comparison with other sources, tomato contains maximum amount of lycopene. For extraction and isolation of Lycopene from tomato paste bio materials can be used. By various methods of extraction and isolation lycopene can be extracted.

#### REFERENCES

1. PramPramYodjun, KhantongSoontarapa, and ChumitaEamchotchawalit. Separation of Lycopene solvene mixture by Chitosan Membranes. Journal of metals, materials and minerals. 2011;21(1):107-113.
2. NeeluMalviya. Isolation and quantification of lycopene from watermelon, tomato, and papaya. Research journal of recent sciences. 2014;3:68-70.
3. SimranLilwani, Vrinda Nair. Extraction and isolation of Lycopene from various natural sources. IOSR Journal of biotechnology and biochemistry. 2015;1(5):49-51.
4. Vrinda Nair, SimranLilwani. Extraction and isolation of Lycopene from Solanum Lycopersicum and CitrullusLanatus for Bioplastic Colouring. 2016;5(5):235-238.
5. Aghel N, Ramezani Z, Amirfakhrian S, Isolation and quantification of lycopene from tomato cultivated in dezfoul, Iran, Jundishapur. Journal of Natural Pharmaceutical products. 2011;6(1):9-15.

How to cite this article: Pathak SS, Akhade OP, Bhojane KG et.al. A review on recent techniques of extraction and isolation of lycopene from tomato. International Journal of Research and Review. 2020; 7(4): 487-490.

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