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Mini Project on Extraction and Quantification of Lycopene from Tomatoes and Papaya Fruit

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Abstract:- The importance of carotenoids is well documented in literature. Many foods are taken as functional foods due to their special health benefits. Among such foods, tomatoes has been considered as functional foods due to presence of phytochemical named lycopene, associated with anticancer properties. This mini project was done to evaluate three varieties of tomato and papaya for qualitative and quantitative determination of lycopene content in the samples. The project concluded that tomato had the highest lycopene content than papaya. It was also found that the lycopene was present more in sun dried samples as compared to their reference fresh samples. Hybrid Tomato had more lycopene content than local tomatoes.

Keywords:- *Tomatoes, Lycopene, Ether Extract, Fat Soluble, Phytochemicals*

I. INTRODUCTION

One of the carotenoids found in many fruits and vegetables naturally, lycopene has been well documented as a functional phytochemical. Tomatoes and other red fruits and vegetables are the main sources of lycopene.

Lycopene, a fat-soluble pigment with antioxidant and antitumor properties, has been shown to lower oxidative stress by either trapping reactive oxygen species to increase the antioxidant potential or reducing oxidative damage to lipids, proteins, and deoxyribonucleic acid. As a result, it has been shown to lower the risk of cancer and cardiovascular diseases.

Lycopene limits several cancer cells, including prostate cancer cells, as evidenced by its impact on tumour cells. Additionally, based on many documented analyses, we deduce that tomatoes have the highest concentration of lycopene when compared to other sources.

Lycopene is an acyclic carotenoid with a lengthy chain of hydrocarbons from a chemical perspective. Beta-carotene isomer 2,6,10,14,19,23,27,31-Octamethyl-dotriaconta is one of its many names. 2,6,8,10,12,14,16,18,20,22,24,26,30-\stridecaene, All-trans, (all-E), and 4,4-carotene lycopene are also present. It has a chemical formula of C40H56 and a molecular weight of 536.89. Due to its eleven linear conjugated double bonds and two unconjugated double bonds, it is a lipophilic chemical with hydrophobic properties that makes it more soluble in organic solvents like chloroform, hexane, benzene, methylene chloride, acetone, and petroleum ether. Lycopene's chemical makeup is thought to boost its affinity for singlet oxygen and capacity to scavenge free radicals.

II. OBJECTIVES

➢ *Keeping in view the importance of this phyto chemical, the present project was planned with the two objectives*

- Extraction of lycopene from following samples:
✓ Hybrid fresh tomato
✓ Sun-Dried Hybrid tomato
✓ Local fresh tomato
✓ Sun-Dried local tomato
✓ fresh Papaya
✓ Sun-dried papaya

- Comparison of the lycopene concentration of the above samples using quantitative analysis.

III. MATERIALS-METHODS AND FINDINGS

This mini project was done as essential part of the bachelor degree under the supervision of the guide following standard procedures using high quality materials and chemicals. The food samples were procured from the local market according to the requirements.

➢ *Achievement of Objective 1*

APPARATUS REQUIRED Separating funnel, Funnel stand, Beakers, Filter paper, Stirrer, Magnetic stirrer, Pipette, Distilled water, Spatula, Evaporator CHEMICALS REQUIRED Acetone, Petroleum Ether, Anhydrous Sodium Sulphate Powder	 Fig. 1 Apparatus and chemicals used

IV. PROCESSING OF SAMPLES

The fresh tomato samples and papaya were washed with tap water followed by washing with distilled water (DW),then cut into thin pieces, then blended using home blender and packed in bottles as fresh samples for lycopene extraction.

Fig.2 Processing of tomato and papaya samples for extraction of lycopene

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The fresh papaya was washed with tap water, followed by washing with distilled water (DW), then cut into thin pieces, , then sun-dried for a day. After that the dried samples was blended using home blender.

➢ *Extraction of Crude Lycopene*

- Ten grams of the sample prepared was transferred into a beaker containing 150 ml acetone, and agitated with magnetic stirrer for 30 min.
- The filtrate was taken, and re-extracted with extra 150 ml acetone for another 10 min.
- Filtrate was collected, and the extraction was repeated until the colour disappeared.
- Sixty(60)ml of petroleum ether was added into a separatory funnel and a small portion of the acetone extract was added as well using pipette.
- Distilled water was slowly added along the walls of the funnel.
- Two phases were separated, and the lower aqueous acetone phase was discarded.
- Another portion of the acetone extract was added and the partitioning with petroleum ether was repeated until all of the extract was transferred into petroleum ether, then successive washings with distilled water were used to remove the residual acetone.
- The petroleum ether phase was collected in a beaker.
- Then we added a scoop of anhydrous sodium sulphate. Stir it for 5 minutes.
- Again the above prepared mixture was filtered into a new beaker.
- Then filtrate is evaporated by rotary evaporator at 35°C until the final volume (5ml) resulted.
- Anhydrous sodium sulfate is used as an inert drying agent for removing traces of water from organic solutions. Lycopene is fat soluble, it is more commonly extracted with organic solvents such as ethanol, acetone, petroleum ether, hexane, benzene, chloroform, etc.

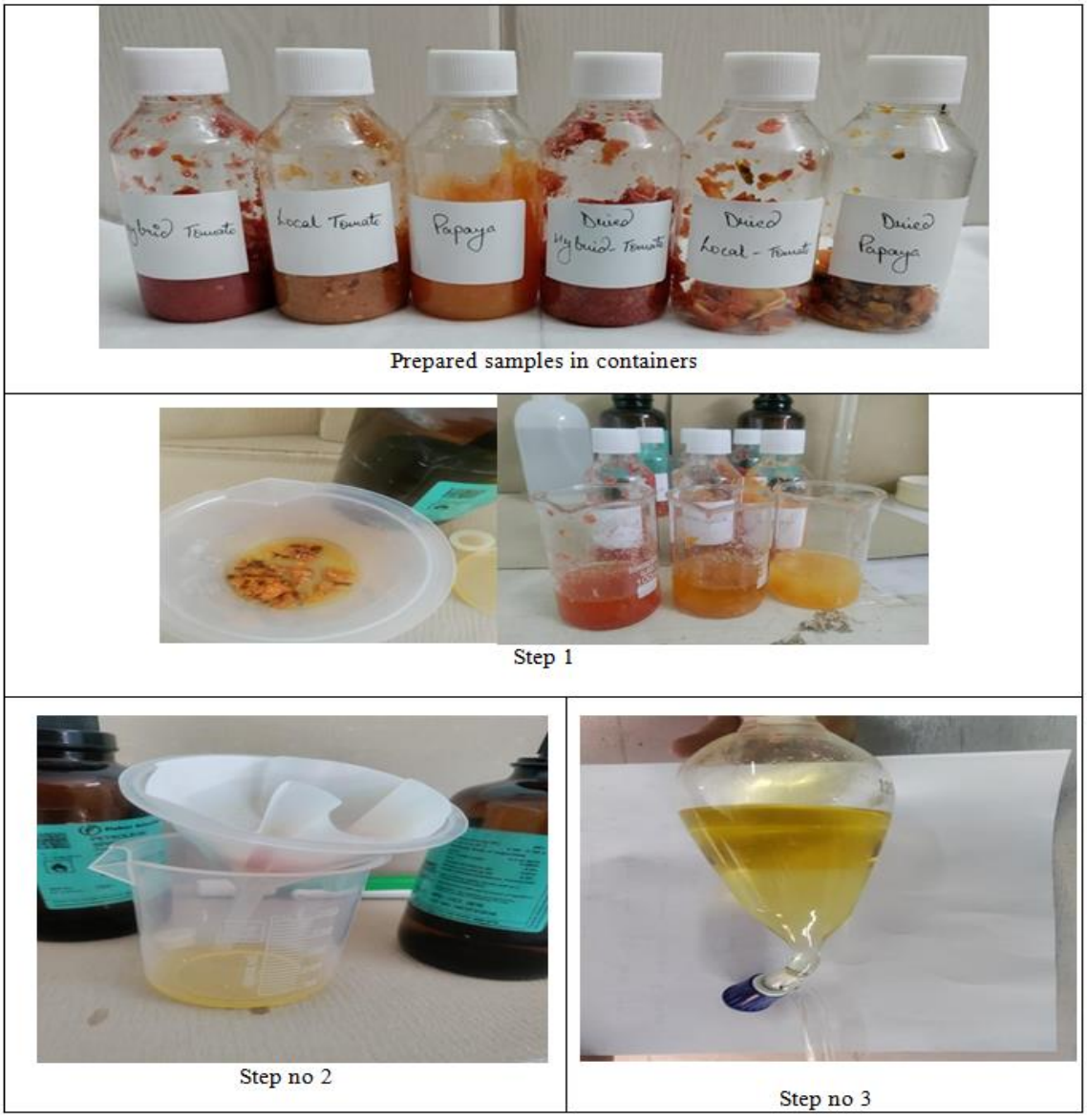

Fig.3 Steps followed for extraction of lycopene

Fig. 4 Extracted Lycopene From The Samples

➢ *Achievement of Objective 2*

- For quantification of lycopene method of Rodriguez Amaya and Kimura, 2001 was followed.

✓ Fifty(50) µl aliquot of petroleum ether phase containing lycopene was taken into 10 mlvolumetric flask and diluted to mark with petroleum ether.
✓ Absorption was measured using a spectrophotometer, in a 1 cm cell at 470 nm. Petroleumether was used as a blank.

Lycopene content was calculated using the equation below.

Total Lycopene Content (µg/g)= A x volume (ml) x 10^4 / A1% 1cm x sample weight (g)

Where A = absorbance;

volume = total volume of extract,

A1% 1cm: absorption coefficient of lycopene in petroleum ether = 3450.

Table No. 1 Lycopene content of different samples

Sample	**Absorbance**	**Total lycopene content (µg/g)**
Hybrid tomato	17.69	51.27
Sun-Dried Hybrid tomato	25.63	74.28
Local tomato	14.75	42.75
Sun-Dried local tomato	20.59	59.68
Papaya	2.36	6.84
Sun-dried papaya	3.56	10.31

Fig. 5 Spectrophotometer quantifying lycopene values

V. CONCLUSIONS AND RECOMMENDATIONS

- Tomato had the highest lycopene content than papaya.
- We concluded that Lycopene is more in sun dried samples as compared to theirreference fresh samples.
- Hybrid Tomato has more lycopene content than local tomatoes.

The intensity of yellow color pigment is directly proportional to the concentration of lycopene in the extracted petroleum lycopene samples. Lycopene is Fat soluble only. Lycopene is important carotenoids which is necessary to consume in regular diets. The extracted lycopene can be inserted into the diet, where natural sources of lycopene are not available. In some industrial processes, where oxygen quenching is required, extracted lycopene can be used. The experiments showed that dried food samples had higher amount of available Lycopene than that from fresh samples, but the degradation of extracted lycopene is greater at high-temperature environments. For human dietary purposes lycopene should be one of the important phytochemical compounds because of its nutraceutical and pharmaceutical importance. From the findings and literature it is also advised to consume these fruits fresh to get maximum health benefits.

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