

# Determination of lycopene from water melon (*Citrullus lanatus*)

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**Abstract**—Water melon was peeled and the reddish flesh ground and oven-dried to make a paste. Ethyl acetate was used to extract the lycopene and the crude product was recovered by simple distillation. The lycopene crystals were obtained through crystallization of crude product by adding a mixture of methanol and benzene. Thin-layer chromatography using silica gel as adsorbent was carried out in order to purify the crystals. This was followed by recrystallization using a mixture of benzene and methanol. Identification was done using UV spectroscopy and the primary chemical test for lycopene was carried out. The quantity of extracted lycopene was measured and found to be 1.62mg per 50g water melon paste. Lycopene from water melon can be produced in commercial quantity and consumed as food supplement in order to reduce high death rate and enhance life span.

**Key Words**—Lycopene, Water melon, Solvent extraction, Ethyl acetate.

## I. INTRODUCTION

Agricultural chemistry is the study of both chemistry and biochemistry which are important in agricultural processing and production of raw products into foods and beverages. These studies emphasize the relationships between plants, animals and their environment. The science of chemical composition and changes involved in the production, protection and use of crop and livestock are fundamental science as it cut-across to test table chemistry, all the life processes through which humans obtain food and fiber for themselves and feed for their animals as an applied science or technology. It is directed towards control of those processes to increase yields, improve quality and reduce costs.

Younger ones are no longer interested in agriculture as they are more interested in the internet. The people interested in agriculture are those from forty years and above. These set of people are prone to diseases such as high blood pressure, cancer, cardiovascular diseases e.t.c. which makes them more susceptible to premature death. Man power is the most important input in African farming. In order to sustain that man power, the health of those that participate in agriculture must be protected with the use of natural supplements such as lycopene to improve their life span.

Lycopene is a dark red carotene and carotenoid pigment phytochemical found in water melon, tomatoes and other red fruits and vegetables. Although lycopene is chemically a carotene, it has no vitamin A activity [1]. It is a highly unsaturated hydrocarbon with 13 double bonds, it was reported by Rao in 2003 that the unsaturated bonds are conjugated [2]. Conjugated bonds of lycopene molecules give it ability to act as antioxidants and make it more effective for the use of human health [3]. It helps to protect the body by neutralizing the negative effects of oxidants and also fight against deadly diseases which include cancer and cardiovascular diseases. Lycopene activity in the body depends on its molecules and physiochemical properties and site of action with cells. It has exhibited scavenging ability for single oxygen due to excited energy state related to conjugated double bonds. It is an efficient antioxidant and has ability of trapping free hydrogen radicals [4].

Slomski in 2001 reported that lycopene is freely soluble in ethyl acetate and n-hexane, partially soluble in ethanol and acetone and insoluble in water [5]. Susame acknowledged that a solution in n-hexane displays three absorbance maxima at 443, 471 and 502nm with the absorbance maximum at 471nm. A peak at 360nm would indicate the presence of certain cis-isomers [6]. When a solution containing lycopene in acetone is treated with 5% solution of sodium nitrate and 1mole sulphuric acid the colour disappears. Furthermore, lycopene when dissolved in concentrated sulphuric acid imparts an indigo blue colour to the solution. Another test is by adding a solution of antimony trichloride in chloroform to a solution of lycopene in chloroform, an intense unstable blue colour appeared. These tests primarily proved the presence of lycopene in any extract [7].

Water melon is specie containing cultivated semi-domesticated and wild forms, widely distributed in tropical and subtropical areas [8]. It is mostly cultivated as an under sown intercrop together with cereals or root crops [9] in the same way as other cucurbits. From a nutritional point of view, the red and sweet water melon flesh is an important source of carotenoids, including lycopene and beta-carotene which is a precursor of vitamin A [3]. Water melon is rich in lycopene, a non-provitamin A carotenoid that has up to twice the antioxidant capacity of beta-carotene [10].

Other research on lycopene bioavailability has focused in tomato products which represent 80% of lycopene in tape in the U.S diet [11]. Other natural food sources include guava, pink grapefruit, apricots, persimmons, and red-fleshed papaya, although the contributions of these foods to dietary lycopene are limited [11]. The mean lycopene concentrated of water melon (4868 $\mu$ g/100g) is about 40% higher than the year round mean per raw tomato (3025 $\mu$ /100g) [12] and water melon ranks 5<sup>th</sup> among the measure contributors of lycopene in the U.S diet [11].

However, the bioavailability of lycopene from water melon has not been evaluated. Carotenoids absorption from plants is generally poor relative to carotenoid supplements [13] and varies with several factors including accessibility from the plant matrix. Considering the facts; this research work was carried out in order to characterize water melon with special reference to lycopene as a food supplement.

## II. MATERIAL AND METHODS

### a) Sample collection and identification

The water melon was bought from Nkwo Ogbe market in Ihiala, Anambra State and identified by Dr. Ukpaku, a botanist in the Department of Biological Science, Chukwuemeka Odumegwu Ojukwu University, Uli.

### b) Sample preparation

The water melon was carefully examined, selected and washed with water to remove dirt and dust particles. It was dissected to obtain the reddish part. The water melon seeds were removed to obtain a homogenous sample. The reddish part was blended to obtain a paste, oven dried at 100°C for 2hours and stored for further analysis.

### c) Procedure used for extraction

Solvent extraction was used to extract the lycopene from the water melon paste. 50g of water melon paste was weighed and placed in a clean beaker. 50ml of ethyl acetate was added and the mixture was shaken vigorously and continuously stirred. The suspension was separated by filtration using filter paper and the residue treated with another 30ml ethyl acetate. The filtration process was again repeated. The ethyl acetate phase was removed by simple distillation leaving behind the crude lycopene extract.

### d) Purification process

The crude lycopene extract was diluted with 2ml benzene followed by the addition of 1ml boiling methanol. The crystals of crude lycopene were observed. The crystallization process was completed by keeping the liquid at room temperature. The crystallization process was repeated 2 more times using benzene and boiling methanol to wash the crystals. Further purification was achieved by thin-layer chromatography using silica gel as stationary phase, a mixture of n- butanol, ammonia and ethanol

in the ration of 6:2:2 as eluent. After the chromatographic process, the deep red zone was collected. It was allowed to evaporate and was again dissolved in 2ml benzene and 1ml boiling methanol was added. Recrystallization occurs and no colourless substance was observed under a microscope. The crystals were weighed and stored in a dry dark bottle.

### e) Identification

Primary identification test was performed using colour chemical reactions. Identification of chemical structure of the isolated lycopene was done using UV spectroscopy

## III. RESULTS

The lycopene crystals was weighed after thin-layer chromatography and re-crystallization and found to be 1.62mg per 50g of water melon paste. Further identification was carried out by adding few crystals of extracted lycopene in concentrated sulphuric acid, the deep-red colour solution changes to indigo blue. Crystals of lycopene were also dissolved in acetone, after the addition of a 5% solution of sodium nitrate and 1m sulphuric acid, the colour disappeared. These tests served as a confirmatory test for the presence of lycopene in the extract. UV spectroscopy was used to test the purity. The wavelengths obtained are 443.2, 472 and 503nm with the maximum absorbance at 472nm

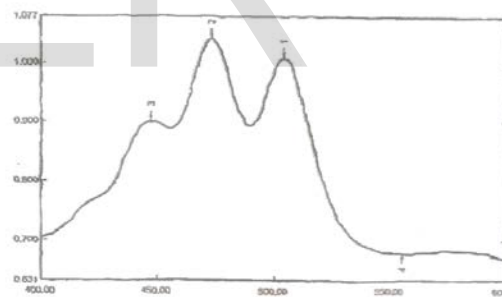


Fig. 1 Spectre of lycopene

## IV. DISCUSSION

Primary identification test performed using colour chemical reactions proved the presence of lycopene in water melon and this comes in agreement with [7]. The extent of purity of the lycopene crystals extracted was proved by the UV spectrum as shown in fig. 1 and it is in agreement with [6]. Ethyl acetate is a good solvent for the extraction of carotenoids due to the ease at which it extracted lycopene from the water melon paste. The yield of lycopene from water melon which is 1.62mg per 50g of water melon paste is good and can be substituted with that of tomato. Lycopene obtained from water melon can be used as food supplements which help to prevent the growth of cancerous cells in the body due to its antioxidant property thereby improving the life expectancy of those who engage in agricultural production. Also, it

should be incorporated into body creams, lotions to help free the skin from radicals and also help in toning of the skin.

## V. CONCLUSION

The results obtained shows that water melon with a yield of 1.62mg of lycopene per 50g of water melon phase can be a good and natural source of antioxidant such as lycopene. The spectrum of the extracted lycopene proved the extent of its purity. Doctors and nutritionists should encourage the incorporation of lycopene into our daily meals in order to help boost our immune system against cancerous cells.

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