



A Potential Source of Omega - 6 and Omega -9 in Capsicum Annum Seed Oil from Jhunjhunu, Rajasthan India

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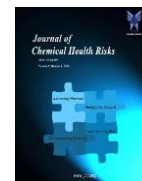
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KEYWORDS

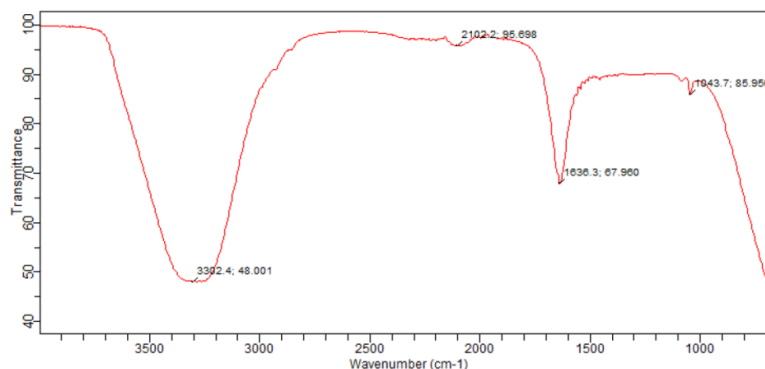
Heavy metal analysis, MP-AES, Capsicum annum, Omega-6, Omega-9, Fatty acid composition, Trace elements, GC-FID.

ABSTRACT:

Vegetable Capsicum (*Capsicum Annum L.*) also known as sweet pepper are most consumed spices in the world. It belongs to the Solanaceae family. It derived from Greek word 'Kapto' means bite or swallow. The capsicum plant contains a chemical called capsaicin which help to reduce pain & swelling. It also contains important pigments like chlorophyll, anthocyanin and lutein, which has many health benefits. Capsicum peppers are considered to be warm season, day neutral plants, although certain forms show photoperiod reaction. Capsicum annum seeds were an inexpensive and dietary supplement for improving human health. It is used in painful situations like rheumatic diseases, migraine, arthritis and in painful diabetic situations with the development of modern technologies made easy to use of medicinal herbs and determination of all components in chili pepper. The accumulation of heavy metals in seed oil of Capsicum annum were mainly K, Ca, Mg, Fe, Na, Zn, Cu and Mn. Samples of Capsicum annum seed oil cultivated by industrial waste nearby areas of Khetri, Jhunjhunu Rajasthan were collected and on digestion of oil for heavy metals. The following heavy metals were obtained (in mg/100g) Potassium (K) 560.32, Magnesium (Mg) 219.40, Calcium (Ca) 152.33, Iron (Fe) 31.29, Sodium (Na) 14.01, Zinc (Zn) 6.89, Copper (Cu) 5.35, Manganese (Mn) 3.11, by using MP-AES (Microwave Plasma Atomic Emission Spectrometers). Analyses of heavy metal content indicated that the most abundant mineral in Capsicum annum seeds was potassium, followed by Ca, Fe, Zn, Mg, Mn, Na. On GC-FID (Gas Chromatography - Flame Ionization Detection) analysis, the extracted oil mainly composed of poly-unsaturated fatty acid with higher percentage of Linoleic acid (omega-6) (C18:2) 56.88%, Oleic acid (omega-9) (C18:1) 23.57% Palmitic acid (C16:0) 11.99% and Stearic acid (C18:0) 4.72 %. Linolenic acid (C18:3), Arachidic acid (C20:0), Gondoic acid (C20:1), Behenic acid (C22:0) are present in lesser amount. Omega-6 and Omega-9 fatty acids are a kind of polyunsaturated fats. Omega-6 is utilized for lessening the danger of coronary illness, bringing down absolute cholesterol levels, and reducing cancer risk. The dietary benefit of oleic acid (omega-9) in a decent eating routine has been the subject of various investigations with specific highlights on the cardiovascular system.



Graphical Abstract

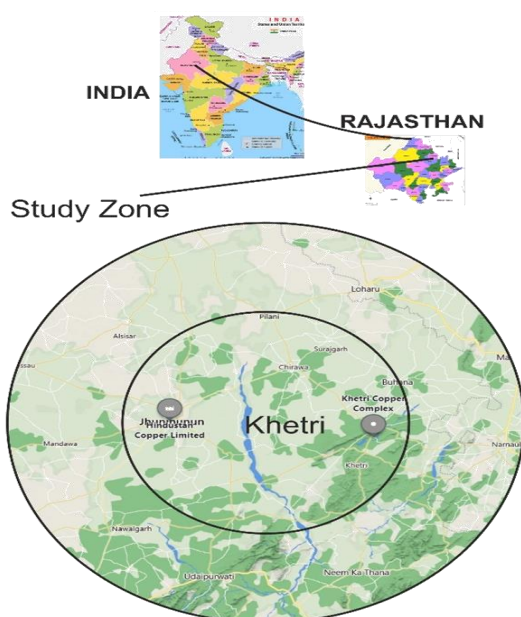


INTRODUCTION

Capsicum annuum (Pepper) is an economically important vegetable crop due to its nutritional value, antioxidant compounds, bioactive products, and natural colours for human health. Pepper is considered as salt sensitive or moderately salt sensitive based on the growth stage.

According to botanical classes, peppers as plant vegetables are within the Solanaceae family and the *Capsicum* genus. Within the genus, the *Capsicum annuum* species is the most cultivated one and there are a lot of varieties of *Capsicum annuum*.

Map showing the study zones



The pepper fruits (*Capsicum annuum*) in different forms, colour, taste, shape, and pungency, and be used fresh, for cooking, or processed into sauces, condiments, spreads, powders, and other products. The oil obtained from the pepper seeds has a pleasant taste which can be compared to other edible oils such as peanut oil and sunflower oil. The oil colour is reddish yellow, indicating the presence of carotenoids. In terms of physicochemical characteristics, pepper seed oil is in the range of other edible oils.

SEED MATERIAL

The seeds of *Capsicum annuum* set in location that gets 6-7 hours of sunlight everyday with temp. of soil from 16-20°C. The seeds were germinating in 7-8 days.

Capsicum annuum will take almost 35-40 days to mature. The soil must rich in organic matter with pH (6.0 – 7.0) with sandy or loamy soil.

The seeds are soaked in water overnight before sowing for better germination. The seeds are also cleaned to remove the mucilaginous materials. The weight of cleaned seeds is approximately 150g.

OIL EXTRACTION

The present study involves extraction of oil from seeds of *Capsicum annuum* by solvent extraction process. The cleaned seeds are dried in the oven at 104°C-108°C for 6 hours and were grounded by using electric grinder and oil was recovered from the crushed seeds by extraction with oil ether (60-80°C) in a Soxhlet apparatus for 6 hrs. The acquired oil was stored in cool spot (cooler) until further investigation.

Fruit and seeds of the pepper (*Capsicum annuum*)

REAGENTS

All reagents were of analytical reagent grade and double deionized water was utilized for all dilutions like as H_2SO_4 , HNO_3 , HF, H_2O_2 , HClO_4 and HCl. All the plastic and glassware were cleaned by soaking in dil. HNO_3 and were rinsed with distilled water before using it. The working standard solution of heavy metals used for calibration were processed by diluting a stock solution of 1000 $\mu\text{g/L}$ (Pb, Cd, Zn, Fe, and Ni).

PREPARATION OF STANDARD FOR METAL

In spectrophotometric determination with respect to the solution having trace concentration of the metal to be determined. It follows that the standard solution which will be required for scanning must also contain trace concentration of the compatible metal. Standards are made by dissolving 1gm of metal Cadmium (Cd), nickel(Ni), iron (Fe), lead (Pb) and zinc (Zn) dissolve in minute quantity of aquaregia (1:3) HCL and HNO_3 , made up to 1 litre in volumetric flask by adding deionized water. This is a stock solution which contains about 1000 $\mu\text{g/L}$ of compatible metal and then the working standard solution is made by appropriate dilution of stock solution. The calibration curves for

metal ions were graphic by taking working standard of 0-40 $\mu\text{g/L}$ as required for the calculations.

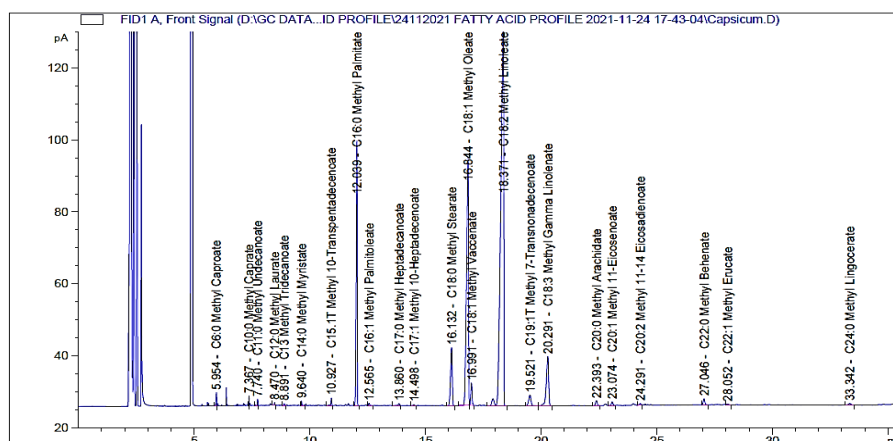
DIGESTION OF SEED OIL

Capsicum annuum seed oil was processed in 100 ml Pyrex glass beaker. For this we took 1g of seed oil added 10 mL Conc. HNO_3 . Kept first for cold assimilation for 24 hours and then heat at 50°C for 4hours. The solution was finally boiled with 1:5 ratio of concentrate acids HCl and HNO_3 in order to process all organic matter and then separated after cooling. Finally, volume of the extract was made up to 25 mL using double distilled water. From the calibration curves for these standard metal ions, concentration of metals in seed oil sample was determined.

RESULT AND DISCUSSION

Fatty acids analysis results:

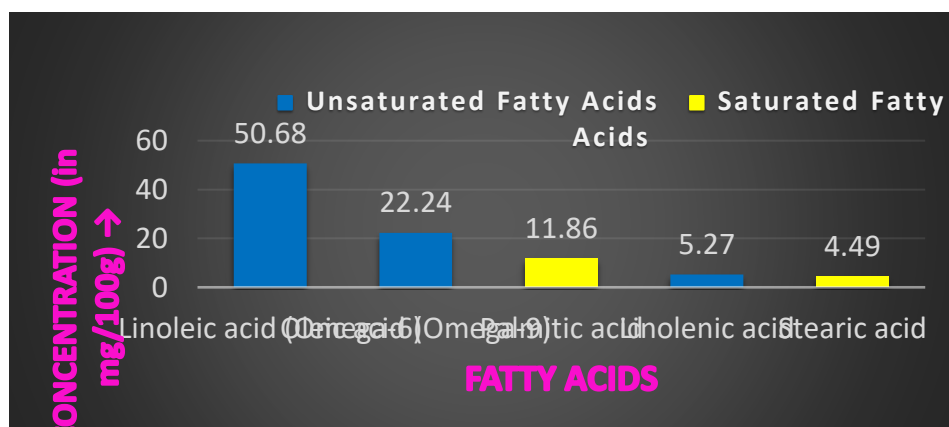
The acid composition of *Capsicum annuum* seed oil obtained by GC-FID were – Linoleic acid (omega-6) (C18:2) 50.68%, Oleic acid (omega-9) (C18:1) 22.24% Palmitic acid (C16:0) 11.86%, Linolenic acid (C18:3) 5.27% and Stearic acid (C18:0) 4.49%. Arachidic acid (C20:0), Gondoic acid (C20:1), Behenic acid (C22:0) are present in lesser amount.

Fatty acid content in *Capsicum annuum*



Fatty Acid	Obtained % by weight
• Linoleic acid (Omega-6)	50.68
• Oleic acid (Omega-9)	22.24
• Palmitic acid	11.86
• Linolenic acid	5.27
• Stearic acid	4.49

Plot showing comparison between Unsaturated and Saturated Fatty Acids



Concentration of heavy metals detected in seed oil of *Capsicum annum*

The accumulation of heavy metals in seed oil of *Capsicum annum* were mainly K, Ca, Mg, Fe, Na, Zn, Mn. Samples of *Capsicum annum* seed oil cultivated by industrial waste nearby areas of Khetri, Jhunjhunu Rajasthan were collected and on digestion of oil for heavy metals. The following heavy metals were obtained (in mg/100g) Potassium (K) 560.32, Magnesium (Mg) 219.40, Calcium (Ca) 152.33, Iron (Fe) 31.29, Sodium (Na) 14.01, Zinc (Zn) 6.89, Copper (Cu) 5.35, Manganese (Mn) 3.11, by using MP-AES (Microwave Plasma Atomic Emission Spectrometers). Analyses of heavy metal content indicated that the most abundant mineral in *Capsicum annum* seeds was potassium, followed by Ca, Fe, Zn, Mg, Mn, Na.

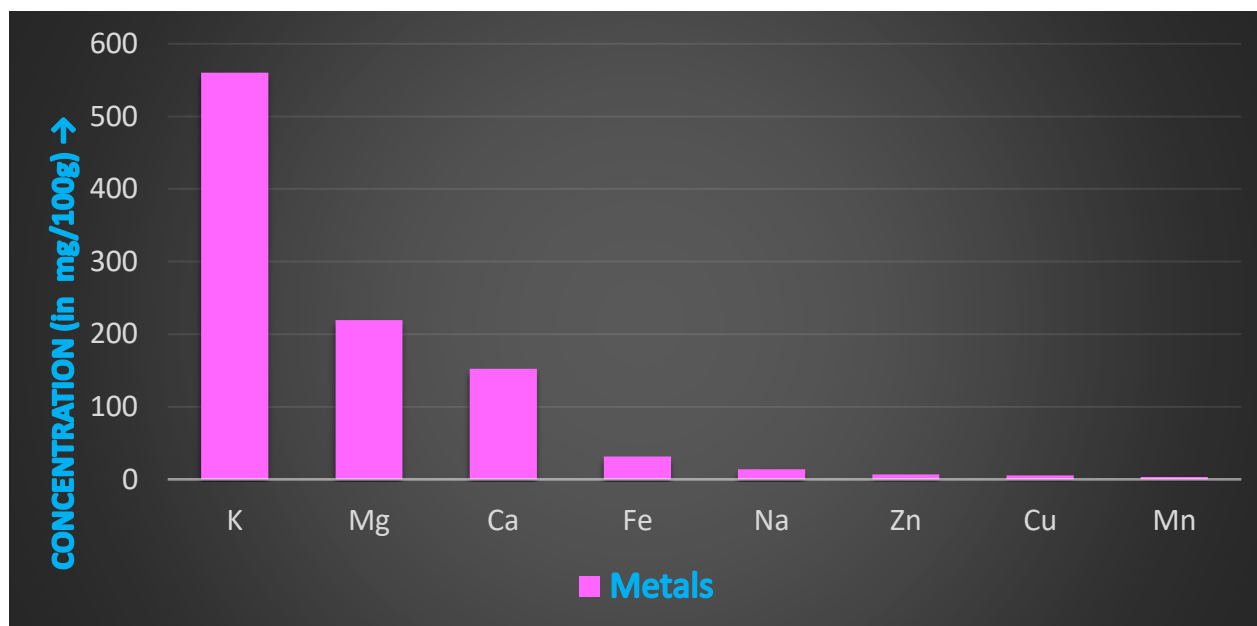
Concentration of heavy metals detected in seed oil of *Capsicum annum*.

Metals	Concentration (in mg/100g)
K	560.32
Mg	219.40
Ca	152.33
Fe	31.29
Na	14.01
Zn	6.89
Cu	5.35



Mn	3.11
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Plot showing comparison between metals concentration in ppm



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