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Research Article

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Analysis of physiochemical properties and fatty acid profile of *Citrullus vulgaris* seed oil

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ABSTRACT

The objective of the study was to determine the physicochemical characterization and analysis of fatty acids composition present in Citrullus vulgaris seed oil. The extraction was carried out by solvent extraction method using petroleum ether (40-60^{0}C) as solvent. The physicochemical properties (iodine, saponification, acid, free fatty acid, peroxide, specific gravity and refractive index) of the extracted oil were assayed using standard methods. The fatty acid profile was analyzed by gas chromatography with FID detector (GC-FID) was used. The seed oil had an golden yellow color and a very characteristic flavour. The oil was also stable at the room temperature. The physical and chemical characteristic shows that the iodine and saponification values are especially high. The specific gravity and refractive index of the oil are also relatively high. GC-MS confirms the presence of fatty acids (palmitic, stearic, oleic, linoleic and linolenic acids). Linoleic acid was the most abundant of the five fatty acids. Fatty acids content in Citrullus vulgaris has great applications as vegetable oils and could be utilized for therapeutic benefit.

Key words: Physicochemical, fatty acids, *Citrullus vulgaris*, linoleic acid, seed oil

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INTRODUCTION

Lipids are nutritionally important, they are either fats (solid) or oils (liquid) that consist of fatty acids with 12- 20 carbon atoms. Most of the lipids found in food are in the form of triglycerides which are fatty acids ester of glycerol. Other types of dietary lipids are cholesterol and phospholipids. Neutral lipids (NLs) are important elements in human nutrition. Apart from reducing the bulkiness of foods in the mouth, NLs are essential in the bio-synthesis of corticoids and steroidal hormones. Dietary, unsaturated fatty acids are essential for optimum health; as they are endogenous precursors of membrane polyunsaturated fatty acids (PUFs) and eicosanoids. Fatty acids, sourced from NLs, are as well important bio-energy molecules, and at times play leading roles in the reduction of body cholesterol levels; as indicated by omega-3 fatty acids. Furthermore, fatty acids are important matrix in drug delivery and targeting [1]. The dietary requirement for lipids is obtained from linoleic and linolenic fatty acids.

Cucurbitaceae is a plant family, also known as gourd family, which includes crops like cucumbers, squashes, luffas and melons. Cucurbits form an important and a big group of vegetables crops cultivated extensively in the subtropical and tropics countries. The family consists of about 118 genera and 825 species [2]. Plants of this family have many medicinal and nutritional benefits [3]. *Citrullus vulgaris* (Schrad), water melon, belongs to family cucurtbitaceae cultivated throughout the earth. The watermelon fruit has deep green or yellow colored smooth thick exterior rind with gray or light green vertical stripes. Inside the fruit is pink, red or even yellow in color with small black seeds embedded in the middle third of the flesh. Generally, watermelon flesh is the main consumable portion;

however, outer rind is also used in some parts of the world [4, 5]. Watermelon with red flesh is a significant source of lycopene. Its seeds are cooling, diuretic and strengthening [6, 7], aphrodisiac [6], seeds are reported also as demulcent, vermifuge and nutritive [7]. Fruit contains carotene, lycopin, mannitol, 20-40% of oil from seeds. Seeds are rich source of the enzyme urease. Juice contains citrulline to the extent of 0.17% [6]. The present study is designed to explore the preliminary physicochemical and phytochemical evaluation of *Citrullus vulgaris* seeds and its antioxidant activity, which is responsible for its pharmacological activities.

This present work was aimed to determine the physicochemical properties and fatty acid composition present in *Citrullus vulgaris* seeds which can have applications in food, pharmaceutical and cosmetics industry.

EXPERIMENTAL SECTION

Seeds of *Citrullus vulgaris* were purchased from a local market at Kolhapur, Maharashtra State, India. The seeds were screened to remove the bad ones. The seeds were ground using mechanical grinder, put in air tight container and stored in desiccator for further analysis.

Extraction of seed oil

Oil from the seeds of *Citrullus vulgaris* was extracted according to the method described (A.O.A.C., 1990) by continuous extraction in soxhlet apparatus using petroleum ether (40-60^{0}C) as solvent [8]. At the end of the extraction, the extraction solvent was evaporated in a rotary evaporator. The extracted oil was assayed using standard methods.

Physicochemical Characterization of seed oil

The physicochemical properties of the extracted oil were assayed using standard methods. The iodine, saponification, acid, free fatty acid, peroxide, specific gravity and refractive index were used to characterize the oil from standard procedure [9, 10].

Fatty acid Profile

Preparation of sample:

To prepare the samples the derivatization method was used which is based on the transesterification catalyzed with acid technique. 200 µl of oil was extracted, 1 ml of hexane was added, and then 10 ml of 5% HCl in CH_3OH were prepared. This solution together with the samples were refluxed for 2 h at 70^{0}C; then 5 ml distillated water were added and left to stand for 10 min; 2 ml of hexane HPLC grade were added to separate the sample on a special funnel.

Fatty acid analysis by GCMS

Fatty acids analysis was performed by using a gas chromatographer Shimadzu GC-17.A, with a Supelcowax column (30m x 0.25mm ID 0.25µm) and a FID detector at 280^{0}C. Injection mode: split, rate 20:1, flux 1.0 ml/min, injector temperature 250^{0}C; Temperatures programmed in column: 40^{0}C till 130^{0}C at 15^{0}C per minute, then incremented to 240^{0}C (10 min) at 30^{0}C per minute, finally incremented to 250^{0}C at 10^{0}C per minute. Fatty acids metylsters standards were used for comparisons, including retention indexes for those components not identified by standard chromatography. Measurements were done by triplicate and results are shown as average values.

RESULTS AND DISCUSSION

Physiochemical characterization of *Citrullus vulgaris* seed oil:

The seed oil extracted from *Citrullus vulgaris* had an golden yellow colour and a characteristic flavour. The yield of oil was 54.68%. The oil was also stable at the room temperature. The physicochemical characteristic of the seed oil are summarized in Table 1. The results clearly show that the iodine, peroxide and saponification values are especially high. The specific gravity and refractive index of the oil are also relatively high. The physical results from the oil indicated that these properties of the seed oil are similar to oils rich in linoleic acid. Saponification value indicates the average molecular weight of oil; which was found to be 132.33 mgKOH/g for *Citrullus vulgaris* and high saponification value indicates greater proportion of fatty acids of low molecular weight. The acid value was found to be 6.48 mgKOH/g, which indicates that the oils are not rancid. The peroxide values of *Citrullus vulgaris* seed oils were obtained to be 21. The peroxide value is the measure of oxidative rancidity of oil. The specific gravity

of the oils was found to be 0.915 and the refractive index was 1.46. The specific gravity and refractive index measures the purity of the oil. The results indicate that the oils are of high purity.

Table 1: Physiochemical characterization of *Citrullus vulgaris* seed oil

Determinations	Results
Saponification value	132.33 mgKOH/g
Acid value	06.48 mgKOH/g
Peroxide value	21 Meq/kg
Iodine value	123 gI_2/100 g
Specific gravity	0.915
Refractive index	1.46

Fatty acid profile of *Citrullus vulgaris* seed oil

In the fatty acid analyzed samples by GCMS, the corresponding 'picks' to fatty acids metylester standards at different retention times corresponding to respective fatty acid (palmitic, stearic, oleic, linoleic and linolenic acids) are represented in Fig. 1. Chromatograms show five signals in which each pick showed the fatty acids present in *Citrullus vulgaris* seed oil (Fig 2). The fatty acid profile of *Citrullus vulgaris* seed oil by gas liquid chromatography indicated presence of fatty acids such as palmitic, stearic, oleic, linoleic and linolenic acid. The fatty acid composition of the oil is in agreement with values obtained in previous studies [11]. Of the five fatty acids listed in table 2, linoleic acid is the most abundance of 64.32%. Linoleic acid is essential for humans since they lack of enzymes needed to insert double bounds in carbon atoms that are further than carbon 9. It is important due to its role as precursor for long fatty acids chains, like arachidonic acid, this characterized the acid as essential for food metabolism [12]. The total saturated and unsaturated fatty acids contents of the *Citrullus vulgaris* seed oil are 17.9 and 82.9%, respectively.

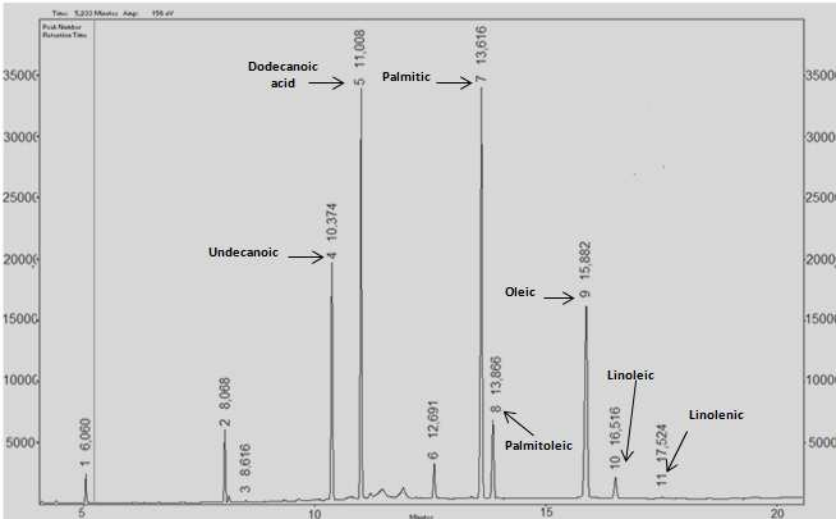

Fig. 1 Chromatogram of methyl ester fatty acids (FAME) (standard 99.98%)

Table 2: Fatty acid profile of *Citrullus vulgaris* seed oil

'picks' number	Retention time (min)	Fatty acid	Percentage Composition
1	13.660	Palmitic	10.64
2	15.616	Stearic	6.33
3	15.940	Oleic	15.65
4	16.610	Linoleic	64.32
5	17.624	Linolenic ME	5.14

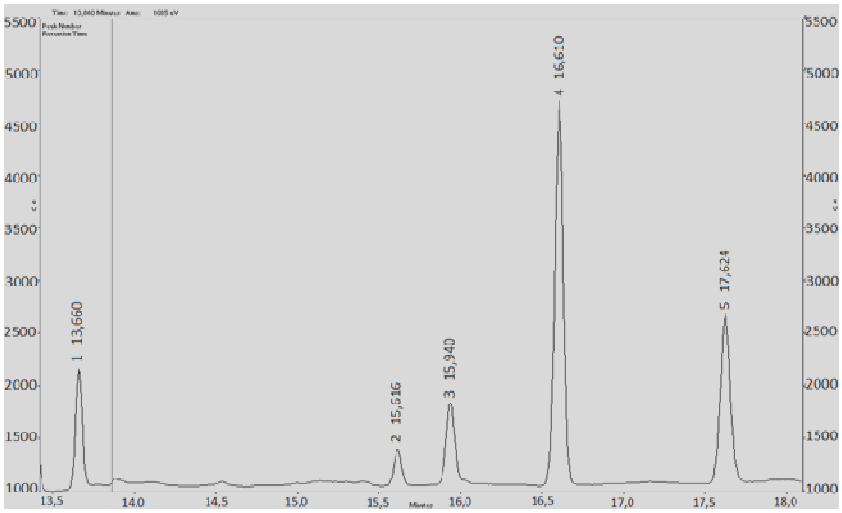

Fig 2 GCMS chromatogram of *Citrullus vulgaris* seed oil

CONCLUSION

The result of the study reveals that *Citrullus vulgaris* oil has good lipid content with an average oil yield 54.68%. The fatty acids present were palmitic, stearic, oleic, linoleic and linolenic acids. Linoleic acid was the most abundant of the five fatty acids. Fatty acids content in *Citrullus vulgaris* has great applications as vegetable oils and could be utilized for therapeutic benefit.

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