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Studies on Physico-chemical Properties and Fatty Acid Composition of Kakri (*Cucumis momordica* L.) Seeds Oil From The Arid Zone of Rajasthan

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In present study, physico-chemical characteristics and fatty acids composition of kakri (*Cucumis momordica* L.) seeds oil were determined. Oil contents, protein contents, moisture content, free fatty acid, saponification values, iodine values, refractive index, specific gravity, unsaponifiable matter and fatty acids composition of oils extracted from seeds were determined. The oil content was 22.22 %. The oil consists of 68.16 % of unsaturated fatty acids and the main fatty acids are linoleic acid (52.63 %), palmitic acid (21.05 %), oleic acid (14.33 %), stearic acid (10.79 %) and linolenic acid (1.20 %). The other characteristics of the kakri seeds oil are approximately as follows: protein contents, 16.40 %; moisture content, 7.0 %; free fatty acid, 3.6 %; saponification value, 126; refractive index, 1.479; specific gravity, 0.914 g/cm^3; unsaponifiable matter, 2.5 % and iodine value, 176.

Key Words: Physico-chemical properties, Fatty acids, *Cucumis momordica* L., Kakri.

INTRODUCTION

Cucurbitaceae is one of the important plant family in food industry and medicine and widely used for both purposes throughout the world. Vegetable oils have numerous commercial values. Oils and fats satisfy important nutritional requirements of human beings. Vegetable oils are important materials in vanaspati, soaps, paints, varnish and pharmaceutical industry. Certain industrial wastes, such as seeds of certain fruits and vegetable are rich in cheaper sources of fats and oils, provide important nutrients such as proteins, starch, minerals, vitamins and fats[1]. The demand of oils and oil-based products is increasing due to increase in population. Due to growing demand and scientific awareness about the nutritional and functional properties of oils[2], the quality assessment and composition analysis of oils from non-conventional oil seeds is a current focus of international research. Some reports are available on the characterization of non-conventional oil seeds from different geographical areas[3-5]. The use of cucurbit seeds as sources of oils and proteins have been reviewed by Jacks *et al.*[6].

In India, the production of seeds oil have increased from 16.9 million tonne in 1991-1992 to 22.43 million tonne during 1995-1996 as against the demand of 72.7 lakh tonne as worked out by the department of civil supplies and by the year 2008

the demand of more than 130 lakh tonne of edible oil and the shortage has been estimated by different agencies varying from 20 to 30 lakh tonne. The total demand for edible oils is expected to increase from the current level of 130 lakh tonne to 156 lakh tonne in 2010 and further to 208 lakh tonne by 2015[7]. In view of the above position of demand and supply of oils and fats, fundamental research on the chemistry of non-traditional oils and fats is required.

In the course of our research the seeds oil of *Cucumis momordica* L. is been analyzed. The prime target of the present study is to perform chemical screening of the seed oil from lesser known families from the arid zone of Rajasthan. The results of these studies are discussed in this paper.

EXPERIMENTAL

Cucumis momordica ripe (mature) fruits were collected and identified from the regions of desert areas of Jodhpur and Jaisalmer in India. Seeds were separated from ripe fruits and were dried in oven and were used for oil extraction. All chemicals and solvents used were of analytical grade.

UV 1601 series (Shimadzu), UV-Vis double beam spectrophotometer with 1 cm matched quartz cells was used for the measurement of absorbance. IR spectra (film in 1% CCl_4) were recorded on Perkin-Elmer Model 521. GC analysis was carried out on a Shimadzu GC 17A gas chromatograph equipped with a flame ionization detector and a 30 mm × 0.25 mm SP-2330 column coated with 0.20 μm 10 % diethylene glycol succinate. Nitrogen was used as the carrier gas at a flow rate of 20 mL/min at a column pressure of 42 Kpa. Component separation was achieved following a linear temperature programme of 190-280 °C (2 °C/min). Methods of sample and TLC preparation were performed according to the standard procedures. Shimadzu-AX-200 electronic balance was used for weighing the samples. Class 'A' volumetric glassware were used.

Extraction of oil: The seeds from ripe fruits of *Cucumis momordica* (150 g) were dried in an oven at 75 ºC and then ground into fine powder. Dried and crushed seeds were extracted with petroleum ether (40-60 ºC) and the seed oil was weighed after the evaporation. Fatty acid methyl esters were prepared with 20 % BF_3 /MeOH[8] at room temperature for 2 h following by 78 ºC for 3 h and separated with diethyl ether. The oil content was 22.22 %.

Physico-chemical values: The physico-chemical values like oil contents, protein contents, moisture content, free fatty acid, saponification values, iodine values, specific gravity, unsaponifiable matter and fatty acids composition of oils extracted from seeds were determined according to the standard methods of AOCS[9]. Refractive index was determined with Abbe's refractometer.

Thin layer chromatography: The oil was fractionated qualitatively and quantitatively on 0.25 mm thick silica gel G chromatoplates. These plates were activated at 105 ºC for 2 h. A known weight of oil (10 % solution in chloroform) was loaded in a straight line *ca.* 3 cm above the lower edge of chromatogram. A mixture of

hexane:ether:acetic acid (70:30:1 v/v) was used as a developing solvent[10]. The spots were visualized by charring the plates after spraying with 20 % aqueous solution of perchloric acid. IR spectra were obtained as 1 % solution in CCl_4 and UV spectra were determined using methanol solutions of the samples.

Methylation and purification of methyl esters: The lipid obtained was treated with boron triflouride-methanol[11] for recommended time in test tube with Teflon lined screw cap for the formation of methyl esters which were purified quantitatively by the application of thin layer chromatography using hexane:ether (9:1 v/v) solvent system[10]. The esters were separated with diethyl ether and stored at low temperature for GC analysis. This method of esterification is found to be the most useful and suitable for little amount of sample.

Identification of fatty acids by GC: The methyl ester of the whole oil and its lipid fractions were analyzed for their fatty acid composition by gas chromatography. The apparatus used for this purpose was Shimadzu GC-17A equipped with flame ionization detector (FID) and a 30 mm × 0.25 mm SP-2330 column coated with 0.20 µm 10 % diethylene glycol succinate[12]. The temperature of injector and detector was set at 290 and 260 ºC, respectively. The peaks were recorded on Shimadzu CR-4A chromatopac and were identified by comparing their retention times with those of standard methyl esters analyzed under the same condition.

RESULTS AND DISCUSSION

Physico-chemical properties: The lipids extracted from the seeds of *Cucumis momordica* were free from undesired materials such as glucose, salts, urea, sucrose, *etc*. The seeds contained moisture 7.0 %, protein 16.40 % and ash 2.98 %. The physicochemical properties of extracted oil were determined which showed refractive index 1.4791, specific gravity 0.914, free fatty acid 3.6 %, saponification value 126.0, iodine value 176.0 and unsaponifiable matter 2.5 % (Table-1). Iodine value (176.0) and the % of unsaturated acids (68.16%), which is high as compared to saturated acid (31.84 %). It would appear that the composition of oil is very close to vegetable oil.

TABLE-1
PHYSICO-CHEMICAL CHARACTERISTICS OF
THE OIL FROM *Cucumis momordica* SEEDS

Values	Units	Values	Units
Oil content	22.22 %	Refractive Index	1.4791
Moisture content	7.0 %	Saponification value	126.0
Specific gravity	0.194	Iodine value	176.0
Ash	2.98 %	Free fatty acids	3.6 %
Protein content	16.40 %	Unsaponifiable matter	2.5 %

Fatty acid composition: The gas liquid chromatographic analysis of the total lipids indicates that the amount of linoleic acid was maximum (52.63 %), oleic

acid was the second major unsaturated acid (14.33 %) present in the oil with minor amount of saturated acid except palmitic acid (21.05 %) (Table-2). These results are in accordance to earlier reports, which shows that stearic acid, linoleic acid, oleic acid and palmitic acid are major fatty acids in most of the species of Cucurbitaceae[13,14].

TABLE-2
FATTY ACIDS COMPOSITION OF THE OIL OF *Cucumis momordica* SEEDS

Fatty acids		%
Myristic acid	C14:0	Trace
Palmitic acid	C16:0	21.05
Stearic acid	C18:0	10.79
Oleic acid	C18:1	14.33
Linoleic acid	C18:2	52.63
Linolenic acid	C18:3	1.20
Arachidinic acid	C20:0	–

Conclusion

The present study indicates that the seed oil is fit for edible purpose as it contains a low percentage of free fatty acids. The fatty acid composition of oil showing higher contents of unsaturated acids (68.16 %) indicates its close resemblance to the vegetable oil. Such oils can be recommended for edible purpose on the basis of their fatty acid composition. The predominant saturated fatty acid was palmitic acid and among unsaturated acids the oil has been reported to contain a high percentage of linoleic acid (C18:2) and is a general characteristic of seed oil of Cucurbitaceae family. The present study therefore was an attempt to explore the parameters of the fixed oil of *Cucumis momordica* to know further possibilities of its application.

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