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Physico-chemical analysis of two seeds oils from plants belonging to zygophyllaceae family

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ABSTRACT

In present study, physico-chemical properties and fatty acids composition of Fagonia indica and Tribulus terestris both belonging to Zygophyllaceae family were determined. The oil contents were 13.96% and 10.87% in Fagonia indica and Tribulus terestris respectively. The oil of Fagonia indica consists of 84.1 % unsaturated fatty acids and the main fatty acids are linoleic acid (49.8%), palmitic acid(9.7%), oleic acid(27.5), stearic acid(7.0) and linolenic acid(6.8%). The oil of Tribulus terestris consists of 75.0 % unsaturated fatty acids and the main fatty acids are linoleic acid (18.6%), palmitic acid (10.6%), oleic acid (35.5%), stearic acid(8.3%) and linolenic acid(20.9%).The Saponification value for the oil of Tribulus terestris was found to be higher than that of Fagonia indica but vice versa for the Iodine values of both the oils.

Key words: *Fagonia indica, Tribulus terristris* and Fatty acids.

INTRODUCTION

Zygophyllaceae is a wide spread family of some 27 genera and 285 species subdivided into five sub families [1-2]. It mainly consists of herbs shrubs and trees growing in arid and semi arid zone of tropical and subtropical areas. The present research paper contains the comparative study of fatty acids profiles of the two plants belonging to Zygophyllaceae family i.e.; Fagonia indica and Tribulus terristris. Fagonia indica is a small, spiny under shrub mostly found in the deserts of Asia and Africa [3]. It is reputed to be medical plants in scientific and folkloric literature and its medicinal values are well documented [4-7]. Species of Fagonia indica have been found to contain proteins and amino acids [8], terpenoids [9], sterols [10], saponins [11], flavinoids[12] , coumarins [13] and other trace elements [14]. Tribulus terrestris is also found in tropical areas. It is also known as puncture vine. Its fruit is used to improve human sexual. It has also been used for years to treat libido and infertility problems [15]. Due to rapid increase in population, last few decades our country is facing oil crisis and a huge amount of foreign exchange is used to import oil from foreign countries. The objective of this research paper is to explore new non-traditional sources of oil so as to make our country self sufficient in production of oil.

EXPERIMENTAL SECTION

Seed samples were collected from arid zone of Rajasthan. After proper cleaning, drying and weighing these were extracted with soxhlet using petroleum ether (40-60^{0}C) and the solvent was evaporated in vacuum using rotary evaporator. The analytical values of oil seeds were determined by using standard methods of AOCS [16]. The refractive indexes of the oils were recorded by Abbe's refractrometer. The protein content of defatted seeds was determined by Kjeldahl method.

Saponification value: - To determine the saponification value the weighed oil samples were treated with 50ml of 4% alcoholic solution of KOH. This mixture was refluxed for 2-3 hours. After cooling the mixture, it was titrated with 0.5N NaOH using phenolphthalein as indicator. A blank determination was also carried out.

Iodine value: - The Iodine values of the oils were determined by using Wiz's method. To determine the Iodine value, the weighted oil samples were made to reacted with 25ml Wiz's solution and 25ml carbon tetrachloride in a round bottom flask. The flask was kept in dark for 30 minutes. To this mixture add 20ml of 15% KOH and 100ml of water were added. The Iodine liberated was then titrated against 0.1N sodium thiosulphate solution using 1% solution of starch as indicator. A blank titration was also carried out.

Thin liquid chromatography: - The thin layer chromatography was carried out by using 0.25mm thick layer of silica gel G. The developing solvent used for this purpose was hexane-diethyl ether-acetic acid (80:20:1, V/V). The visualization of spots was made by using Iodine chamber.

UV spectroscopy: - The U.V spectra of oil and methyl esters were recorded by Shimadzu UV-1601 spectrophotometer.

Gas liquid chromatograph technique:-The GLC analysis of the methyl esters were carried out by using Amil Nucon gas chromatograph model-5700 equipped with flame ionization detector.

RESULTS AND DISCUSSION

The physico –chemical properties of seeds of both these plants are shown in Table-I. The oil yield in Fagonia indica (13.96%) is higher than Tribulus terristris. The moisture content in both the seed oils was 6.32% and 5.63% in Fagonia indica and Tribulus terrestris, respectively. The physico –chemical properties of seed oils of both these plants are shown in Table-II. The iodine values for both the species were 114.05 and 125.17 in Tribulus terrestris and Fagonia indica respectively. On considering Iodine value as an indicator, Fagonia indica seed oils are compatible with that of sunflower oil. The iodine value for sunflower oil was within the range of 125-144, which is the most important oil crop [17]. The Iodine value for Tribulus terristris and Fagonia indica were found to be 108.5 and 125.17 respectively, which is within a range of semi drying oils (100- 150). This class of oils absorbs the oxygen on exposure to air and gets thicken and remain sticky. They are used for production of margarine and soap [18-19]. The refractive index values for the Fagonia indica and Tribulus terristris were 1.491 and 1.464 respectively. It is found compatible with that of soya bean (1.466-1.470) and palm kernel (1.449-1.451). The high refractive index of these oils seems to confirm the high number of carbon atoms in their fatty acids [20]. Refractive index increases as the double bond increases [21]. It confirmed that Fagonia indica has higher amount of unsaturated acids than Tribulus terristris. The saponification value for Tribulus terrestris is greater than that of Fagonia indica i.e. 180.3 and 169.5 which indicate that the first has a high content of triglycerol and has potential of being used in cosmetic industry. The component fatty acids of both the seed oils were determined by GLC analyses as shown in Table-III. The PUFA comprises of linoleic acid and linolenic acid. The data showed that the seed oil of Fagonia indica has higher percentage of linoleic acid (18:2) in comparison to Tribulus terristeris, whereas the Linolenic acid (18:3) is present in higher amount (20.9%) in the seed oil of Tribulus terristeris. The other fatty acids such as palmitic (16:0) and stearic acid (18:0) are found in trace amount in both seed oils.

Table-1 Physico - Chemical Properties of Seeds

S.No.	Plant Species	Oil %	Protein %	Moisture %
1	Fagonia indica (Zygophyllaceae)	13.96	27.82	6.32
2	Tribulus terristris (Zygophyllaceae)	10.87	19.2	5.63

Table-2 Physico - Chemical Properties of oils

S.No.	Plants Species	S.V.	I.V.	Unsaponifiable material %	Refractive Index
1	*Fagonia indica (Zygophyllaceae)*	169.5	125.17	4.1	1.491
2	Tribulus terristris*(Zygophyllaceae)*	180.3	108.5	3.7	1.464

Table-3 Component fatty acids of seed oils

S.no.	Plant species	16:0	18:0	18:1	18:2	18:3	20:0
1	Fagonia indica (Zygophyllaceae)	6.5	7.0	27.5	49.8	6.8	2.2
2	Tribulus terristris (Zygophyllaceae)	10.6	8.3	35.5	18.6	20.9	3.8

Table-4 Cumulative Fatty Acid composition

S.no.	Plant species	Total Unsaturated Fatty acid %	Total Saturated Fatty acid %	PUFA%
1	Fagonia indica (Zygophyllaceae)	15.7	84.1	56.6
2	Tribulus terristris (Zygophyllaceae)	22.7	75.0	39.5

Fagonia indica (plant)

Tribulus terristris (plant)

CONCLUSION

On account of total unsaturated fatty acids and PUFA shown in Table –IV, Fagonia indica seed oil is superior as compared to Tribulus terrestris . It has also been found that the amount of PUFA in Fagonia indica is in compatible with that of corn seed oil [22]. So it can be a good substitute for the most commonly used vegetables oils namely cottonseed oil and palm oil, are imported and contain high level of saturated fatty acids, the consumption of which may increase total blood cholesterol and subsequently increase the risk of cardiovascular disease [23]. While on considering saponification value as an indication the seed oil of Tribulus terrestris has potential to be used for industrial purpose.

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