

## Physico-chemical analysis of six seed oils from arid zone of Rajasthan

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### ABSTRACT

The seed oils from six plant species were analysed for their fatty acid composition viz. *Leucaena leucocephala*, *Mucuna prurita* (Leguminosae), *Nigella sativa* (Ranunculaceae), *Sisymbrium irio*, *Brassica juncea* (Brassicaceae) and *Achyranthes aspera* (Amaranthaceae). All the seeds were collected from Arid zone of Rajasthan and their physico chemical characteristics and fatty acid composition were studied by using UV, IR, TLC and HPLC techniques. The oils have been found rich in unsaturated fatty acid and the total unsaturated fatty acids were found in good amount in *Nigella sativa* and *Sisymbrium irio* 73.79 and 88.85% respectively.

**Key words:** Fatty acid composition, minor oil-seeds.

### INTRODUCTION

In India there is a shortage of oils and fats, so there is an absolute need to improve indigenous supply. Though the productions of oil seeds in the country have increased many folds during last few decades but still there is a gap of about 20 lakh tones in demand and supply. This demand and supply gap is continuously increasing due to upsurge in population and improvement in the standard of living.

The non traditional oils are generally not good for human consumption, unless they are properly treated. However, these oils can be a good source of fatty acids which are being used in the industries. Oleochemicals can be derived from these non-traditional oils, but the possibilities of producing new and useful oleochemicals from these oils require extensive research and developmental work.

The dry land of Rajasthan has a good source of wild flora which can be exploited to discover new sources of oils and fats. The physico chemical analyses have been carried out in our laboratory as part of a continuous programming. The oils were chemically and spectroscopically

analysed using techniques as recommended by American Oil Chemists Society<sup>1-8</sup>.

### EXPERIMENTAL

The seeds were collected, cleaned, dried and powdered. The oils were extracted with petroleum ether (40-60°C) using Soxhlet apparatus. The mixed fatty acids were prepared by refluxing oil with acidified methanol. The esters were obtained through extraction with ether.

Thin-layer chromatography (TLC) was carried out on 0.25 mm layers of silica gel G using petroleum ether and diethyl ether in a ratio of 4:1. The spots were visualized by exposure to iodine vapours and then by charring with 20% Perchloric acid spray.

The IR spectra were recorded on Perkin-Elmer 521 or 621 instrument. The UV spectra were recorded on Beckmann DK-2A spectrophotometer. Abbe Refractometer was used for refractive index determination. The fatty acid composition of oil esters were carried out on HPLC Shimadzu SPD-10 AT-VP model with UV detector.

## RESULTS AND DISCUSSION

The UV and IR spectra very clearly showed the absence of any oxygenated fatty ester, conjugation and trans-unsaturation or any other functional group. Silver nitrate impregnated TLC of methyl ester showed spots corresponding to saturated, monoene, diene and triene when run along with linseed ester taken as reference standard.

The unsaturated fatty acids were found in high amount and the amount ranging from 51.44 to 88.85%. The content of oleic and linoleic acid was recorded between 23.61 to 66.96%. The linoleic acid (18:2) was found as major fatty acid in *M. prurita* 42.54% and *A. aspera* 32.97%. Linolenic acid (18:3) a characteristic of vegetables oils has been recorded in all the species between 6.82-32.19%. The major amount of this acid was noticed in *S. irio* 32.19% and *L. leucocephala* 29.29%. Other seeds oils contained appreciable amount of this acid. The combined linoleic-linolenic acid content (PUFA) ranged from 29.22% - 50.65% oils from four species which contained PUFA above 40% are *S. irio* (50.65%), *M. prurita* (49.36%), *L. leucocephala* (43.9%) and *A. aspera* (41.37%). Two seed oils *B. juncea* and *N. sativa* were found to contain PUFA as 31.03% and 29.22% respectively and were classified as semidrying and/ or Non-drying oils.

The saturated fatty acids which are industrially very important were recorded in all the species as palmitic, stearic and arachidic acids. Their amount varied between 11.14-48.46%. The major saturated fatty acid was stearic acid in *A. aspera* 35.01% and *L. leucocephala* 30.77%. Palmitic acid was present in all the species between 3.55 to 20.23% and arachidic acid was recorded in some species as a minor component.

Earlier report by Osman and Co-workers<sup>9</sup> on *M. prurita* showed the presence of epoxy acids but in the present study the epoxy content in the seed oils has not been detected either by picric acid TLC or IR spectroscopy. The result obtained in this report when evaluated in reference to previous work showed that seed oils from same species collected from different habitats varied in compositional values. Such variations are of common occurrence

Table 1: Physico-chemical characteristics of seeds and oils

S. No	Name and Family	Oil %	Protein%	Moisture %	Iodine Value	Saponification Number	UNsap. Matter	Ref Index
1.	<i>Leucaena leucocephala</i> (Leguminosae)	5.46	21.00	5.55	126.20	115.00	6.00	1.4757
2.	<i>Mucuna prurita</i> (Leguminosae)	2.23	24.0	1.733	115.34	103.78	1.90	1.4687
3.	<i>Nigella sativa</i> (Ranunculaceae)	16.9	17.4	4.373	110.00	106.69	3.73	1.4744
4.	<i>Sisymbrium irio</i> (Brassicaceae)	15.28	14.96	4.437	171.69	120.20	3.45	1.4686
5.	<i>Achyranthes aspera</i> (Amaranthaceae)	12.06	13.0	3.723	106.17	96.97	2.10	1.4459
6.	<i>Brassica juncea</i> (Brassicaceae)	14.77	17.0	4.373	93.00	110.56	1.15	1.4787

**Table 2: Fatty acid composition determined by HPLC**

S. No	Name and Family	16:0	18:0	18:1	18:2	18:3	20:0
1.	<i>Leucaena leucocephala</i> (Leguminosae)	16.31	30.77	9.0	14.61	29.29	-
2.	<i>Mucuna prurita</i> (Leguminosae)	20.23	17.46	9.0	42.54	6.82	3.14
3.	<i>Nigella sativa</i> (Ranunculaceae)	13.02	10.72	44.57	22.39	6.83	2.46
4.	<i>Sisymbrium irio</i> (Brassicaceae)	3.55	7.59	38.2	18.46	32.19	-
5.	<i>Achyranthes aspera</i> (Amaranthaceae)	5.62	35.01	15.03	32.97	8.4	2.96
6.	<i>Brassica juncea</i> (Brassicaceae)	16.77	27.79	20.41	20.83	10.2	3.90

**Table 3: Cumulative fatty acid composition**

S. No	Name and Family	Total saturated fatty acid %	Total unsaturated fatty acid%	PUFa %
1.	<i>Leucaena leucocephala</i> (Leguminosae)	47.08	52.9	43.9
2.	<i>Mucuna prurita</i> (Leguminosae)	40.83	59.16	49.36
3.	<i>Nigella sativa</i> (Ranunculaceae)	26.2	73.79	50.65
4.	<i>Sisymbrium irio</i> (Brassicaceae)	11.14	88.85	50.65
5.	<i>Achyranthes aspera</i> (Amaranthaceae)	43.58	56.4	41.37
6.	<i>Brassica juncea</i> (Brassicaceae)	48.64	51.44	31.03

and can be attributed to the geotypic - environmental conditions. From this it might can be concluded that the industrial performance of these oils can catalyse a programme for selection and development of strains suitable for economic production.

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