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PHYSICO-CHEMICAL CHARACTERISTICS AND FATTY ACID COMPOSITION OF SOME NEW VARIETIES OF OIL SEEDS

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ABSTRACT

Five new varieties of oil seeds, viz Arachis hypogaea JGN-3, Brassica compestries VARUNA, Carthamus tinctorius JSF-1, Glycine max JS-90-41 and Helianthus annus KBSH-1 have been studied for their physico-chemical characteristics and fatty acid composition. Distinct differences in free fatty acid (0.41-0.70%), iodine value (95.19-148.47), saponification value (174.83-194.13) and refractive index (1.4630-1.4681) were observed. Qualitative differences were observed in the fatty acid composition. Total saturated fatty acids ranged from (3.11-37.39%); unsaturated fatty acids varied from (62.58-96.87 %). Palmitic, stearic, oleic and linoleic acid were major fatty acids in most of the oil seeds, except in Brassica compestries VARUNA, which contained 9.63% linolenic acid and 65.20% erucic acid.

Key words : Physico-chemical characteristics, Fatty acid composition, Oil seeds, Arachis hypogaea JGN-3, Brassica compestries VARUNA, Carthamus tinctorius JSF-1, Glycine max JS-90-41, Helianthus annus KBSH-1.

INTRODUCTION

Oil and fats constitute an important component of human diet, contributing to calorific value, providing essential fatty acids, fat soluble vitamins and improving taste, flavour, and texture of food[1].

The fats and oils are of great biochemical importance because of their role as chief storage form of energy, which serves as building stone. In addition to edible purpose, they are also commercially important in the form of medicine, soap detergents, lubricants, greases and in various paints and varnish industries. The other possible use of the oil as a diesel fuel may be limited, due to its high viscosity and low volatility. The possibility of

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using vegetable oils as alternative source of fuel has been tried by earlier workers.[2]

Development of hybrid seeds has been considered important so as to produce seeds with better nutritive value and minimize the possibility of the presence of harmful substances.[3]

EXPERIMENTAL

The oil seeds Arachis hypogaea JGN-3, Brassica compestries VARUNA, Carthamus tinctorius JSF-I, Glycine max JS-90-41 and Helianthus annus KBSH-1 were collected from Department of Plant Breeding and Genetics, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur.

The oil was extracted from the whole seed powder in the Soxhlet apparatus for 20 h, using petroleum ether 40-60°C as solvent and estimated gravimetrically[4]. Filtered oil was analysed as per procedure given by Rangna,[5] for free fatty acid, iodine value, saponification value and refractive index.

The fatty acid methyl esters were prepared by the method of Choudhary et al[6]. Separation of the ester was carried out using a NUCON Model No 5700 gas chromatograph DB-6 column with flame ionization detector under the following conditions. The initial column temperature was 100°C; then programmed to 225°C at the rate of 3°C/min, and maintained for 25 min. The temperature of the injector and detector were 240°C and 250°C, respectively. The slow rate of nitrogen was 35 mL/minute. Fatty acids were identified qualitatively and quantitatively as per procedure of Sekhon et al.[7]

RESULTS AND DISCUSSION

The physico-chemical characteristics, saturated and unsaturated fatty acid composition of oil seed samples are reported in Table 1, Table 2 and Table 3, respectively.

Free fatty acid content was found to be highest (0.70) in Glycine max JS-90-41 and lowest (0.41) in Brassica compestries VARUNA. Increase in free fatty acid during storage could be noticed as reported by several workers.[8–10] As rancidity is usually accompanied by free fatty acid formation and so the determination is often used as a general indication of the condition and edible quantity of oils.[8] Yet the PFA rules 1955 has specified the limit as high as 3.0 percent.

Table 1. Physico-chemical characteristics of some new varieties of seed oils

Seed oil	Free fatty acid	Iodine value	Saponification value	Refractive index
Arachis hyogaea JGAN-3	0.53	95.19	193.54	1.4630
Brassica compestires VARUNA	0.41	108.12	174.83	1.4659
Carhamus tinctorius JSF-1	0.54	148.47	192.79	1.4681
Glycine max JS-90-41	0.70	127.36	194.13	1.4658
Helianthus annus KBSH-1	0.49	132.41	191.17	1.4672

Table 2. Sataurated fatty acid comosition of some new varieties of oil seeds under investigation

Oil seeds	Saturated fatty acids (%)						Total saturated fatty acids (%)
	Myristic acid (14 : 0)	Plamitic acid (16 : 0)	Stearic acid (18 : 0)	Arachidic acid (20 : 0)	Behanic acid (22 : 0)	Egnoceric acid (24 : 0)	
Arachis hypogaea JGN-3	-	13.27	7.95	9.60	3.52	3.05	37.39
Brassica compestries VARUNA	-	15.29	2.47	-	-	-	17.76
Carthamus tinctorius JSF-1	1.6	1.8	2.04	-	-	-	5.44
Glycine max JS-90-41	-	2.03	1.08	-	-	-	3.11
Helianthus annus KBSH-1	-	3.23	3.65	12.08	3.23	4.75	26.94

Table 3. Unsaturated fatty acid composition of some new varieties of oil seeds under investigation

Oil seeds	Unsaturated fatty acids (%)				Total unsaturated fatty acids (%)
	Oleic acid (18.1)	Linoleic acid (18 : 2)	Linlenic acid (18 : 3)	Erucic acid (22 : 1)	
Arachis hypogaea JGN-3	28.68	33.90	-	-	62.58
Brassica compestries VARUNA	2.47	4.95	9.63	65.20	82.24
Carthamus tinctorius JSF-1	18.20	76.28	-	-	94.48
Glycine max JS-90-41	14.82	82.05	-	-	96.87
Helianthus annus KBSH-1	7.90	65.12	-	-	73.02

Iodine value was found to be highest (148.47) in Carthamus tinctorius JSF-I and lowest (95.19) in Arachis hypogaea JGN-3, well within the limits of 94-148 as laid down in the Prevention of Food Adulteration Act 1955[11] and Rules, Government of India.

The saponification value was found to be in the range between 174.83 and 194.13, which is in general agreement with the PFA Act and Rules.

Refractive index of Arachis hypogaea JGN-3 (1.4630), Brassica compestries VARUNA (1.4659), Carthamus tinctorius JSF-1 (1.4681) Glycine max JS-90-41 (1.4658) and Helianthus annus KBSH-l (1.4672) were found in good accordance with PFA Act and Rules.

A wide variation in the fatty acid composition of different oil seeds was observed. Palmitic, stearic, oleic and linoleic acids were predominant in most of the oil seeds, except in Brassica compestries VARUNA, which contained 65.20% erucic acid. The level of erucic acid was found to be higher than those reported by earlier workers[11–14]. The high level of erucic acid is the most interesting aspect of this investigation since this acid has been the subject of nutritional studies and shown to be related to atherosclerosis.[15] The use of high erucic acid oil in the diet may cause myocardial fibrosis[16,17] This acid is the most

important in assessing the type and quality of oil and is the main concern in the usage of the oil. Thus, it can be recommended for inedible purposes.

Palmitic and stearic acid contents ranged from 1.8 to 15.29 % and 1.08 to 7.95%, respectively. Both of these are saturated fatty acids and are not desirable for human nutrition. Arachidic, behanic and lignoceric acid were present in Arachis hypogaea JGN-3 (9.60%, 3.52% and 3.05%, respectively). These values are similar to the reported value[18]. Arachidic (12.08%) behanic (3.23%) and lignoceric acid (4.75%) were found in Helianthus annus KBSH-1.

The major monounsaturated fatty acid in the lipids of all oil seeds was oleic acid (ranged from 2.47-28.68%). The highest amount was found in Arachis hypogaea JGN-3. Brassica compestries VARUNA showed lower amounts of oleic acid as reported by earlier workers[13,14]. Higher levels of oleic acid are desirable to impart stability of oils during storage and deep fat frying[19] .

The total polyunsaturated fatty acids ranged from 14.57 to 82.05%. Linoleic acid is the major fatty acid in most of the oil seeds. Glycine max JS-90-41(82.05%) was found to be higher than those reported by earlier workers[7,20]. Carthamus tinctorius JSF-1 (76.28%) has similar value as reported by Nagaraj and Anjani.[19] Helianthus annus KBSH-1 (65.12%) was found to be in close proximity with other verities of Helianthus annus,[21] Linolenic acid was present in Brassica compestries VARUNA (9.63%). This value was found to be in close accordance with the values reported by Krishnamurthy et al.[14] Lower linolenic acid content in the seeds should be regarded as a favourable storage factor. It is known that on storage, linolenic acid gets readily oxidized producing off factor. It is known that on storage linolenic acid gets readily oxidized producing off flavours[3].

Thus, it is evident that oil seeds except Brassica compestries VARUNA are richer in the essential fatty acids namely, linoleic acid and poorer with respect to the undesirable saturated fatty acids and hence, they can be considered superior with respect to oil quality. Linoleic acid is the most important essential fatty acid required for growth, physiological functions and maintenance, which cannot be synthesized by human body and we have to depend on dietary sources for their adequate supply[22, 23].

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