Pak.j. sci, ind. res., vol. 32, no.9, September 1989

THE FATTY ACIDS OF INDIGENOUS RESOURCES FOR POSSIBLE INDUSTRIAL APPLICATIONS

Part XVIII. The Fatty Acid Composition of the Fixed Oils of *Leucaena leucocephala and Cassia holosericea*

SHAMIMA KHALID, GHAZALA SHAHID, NIGHAT AFZA, S. SHAHID HUSSAIN, YASMEEN BADAR, ABDUL SATTAR* AND SHAFIQ AHMAD KHAN*
PCSIR Laboratories Complex, Karachi

(Received May 30, 1989; revised August 26, 1989)

The fixed oils (w/w of *Leucaena leucocephala* (6.93%) and *Cassia holosericea* (5.6%) seeds (N.O. Leguminoseae) have been investigated for their physico-chemical properties and chemical composition. The fatty acid composition of the seed oils of *L. leucocephala and C. holosericea,* as determined by GLC, are lauric (0.118, 0.135%) myristic (0.104, 0.324%), palmitic (14.741, 15.22%), palmitoleic (0.180, 0.008%), steric (6.170, 6.69%), oleic (20.77, 19.064%), linoleic (53.101, 57.323%), linolenic (1.640, 0.10%), arachidic (1.287, 0.560%) and behenic (1.769, 0.011%) acids respectively.

Key woords: Fatty acids, *Leucaena leucocephala, Cassia holosericea,* Saponification.

Introduction

Leucaena leacocephala (N.O.Leguminoseae) has been recognised as quick growing plant and is being introduced in the tropical countries including Pakistan for forage and extra-ordinary amount of wood compared to many other plants [1]. Since the plant has adopted easily to the Pakistani conditions it was of interest to look into the composition of its seeds (15-30 per pod) particularly with a view for obtaining oil.

Cassia holosericea, a small herb, is widely distributed in Sind [2]. The plant bears pods which contain seeds (6–12) that normally go waste. Here again the general interest was to examine the seed oil for any possible utilisation in continuation of the earlier and similar efforts [3]. The present communication, therefore, describes the physico-chemical properties and the fatty acid composition of the seed oils of these two plants.

Experimental

1. *Extraction of oil.* Seeds (20 g each) of *Leucaena leucocephala* and *Cassia holosericea* were separately extracted with *n*-hexane (b.p. 68° ± 2°) in a soxhlet apparatus. The extracts were dried over anhydrous sodium sulphate and the solvent was removed under reduced pressure to yield clear light yellow oils which were stored under nitrogen. The physico-chemical properties of oils as determined by standard methods are given in Table 1.

2. *Saponification of oils.* The oils (300 mg each) were separately saponified by reaction with 0.5 M methanolic potassium hydroxide (50 ml) for 5 hr. The soaps were dissolved in water and extracted with ether (100 ml x 5) to remove the non-saponifiable matter. The residual soap solutions were acidified with 4 N sulphuric acid and the liberated fatty acids were extracted with ether, dried over anhydrous sodium sulphate and the solvent removed under nitrogen atmosphere.

3. *Esterification of the fatty acids.* The fatty acids, from both oils were separately converted to their methyl esters by reaction with diazomethane in ethereal solution at low temperature. The esters thus formed were kept under nitrogen for further examination.

4. *Examination of methyl esters by GLC.* The chemical composition of oils and the percentage composition of the fatty acids was determined by the GLC examination of the methyl esters on a Pye Unicam 204 unit using a glass column (1.5 m x 4 mm) packed with PEGS (20%) on diatomite (80-100 mesh). Other operational conditions were as under:-

(a) Column temperature = 210°
(b) Carrier gas = Nitrogen
(c) Flow rate = 40 ml/min
(d) Detector (flame ionisation) temperatur=250°

TABLE 1. PHYSICO CHEMICAL PROPERTIES OF *L.LEUCOCEPHALA* AND *C. HOLOSERICEA* SEED OILS.

		Leucaena leucocephala	*Cassoa holesericea*
1.	Refractive index (35°)	1.4718	1.4598
2.	Specific gravity (22°)	0.9284	0.9340
3.	Acid value	3.59	6.8
4.	Iodine value	119	178
5.	Saponification value	162	178

*PCSIR Laboratories Complex, Lahore-16

The identification was carried out by running a standard mixture of methyl esters under identifical conditions and comparing their retention times. Confirmation was made by coinjection.

The percentage compositions were recorded with a Pye Unicam DP 88 computing integrator. The results are given in Table 2.

TABLE 2. FATTY ACID COMPOSITION OF THE SEED OILS OF *L. LEUCOCEPHALA* AND *C. HOLOSERICEA*

Component fatty acid %	*L. l eucocephala*	*C. holesericea*
C 12 : 0	0.104	0.135
C 14 : 0	0.104	0.324
C 16 : 0	14.741	15.220
C 16 : 1	0.180	0.008
C 18 : 0	6.170	6.691
C 18 : 1	20.771	19.064
C 18 : 2	53.101	57.323
C 18 : 3	1.640	0.010
C 20 : 0	1.287	0.560
C 22 : 0	1.769	0.011

Discussion

The fatty acid composition and pattern of their distribution in the seed oils of *Leucaena leucocephala* and *Cassia holosericea* (Table 2) is similar to that of the other Leguminoseae seed fats [4,5]. The amount of the unsaturated fatty acids (75.5 and 76.5%) is more than the saturated acids (24.4 and 23.4%) both in *L. leucocephala* and *C. holosericea* respectively. Minor amounts of arachidic, behenic and lignoceric acids are also present.

The fatty acid composition of both oils suggested that with proper refining they could be used for edible purposes. As such, however, they can find direct use in soap making or the paint industry because of their being semi-drying in nature.

The oil characteristics and fatty acid composition of *L. leucocephala* differ from those reported recently [6], but are similar to the general pattern shown by other members of Leguminoseae. The reason for the differences in the evaluations could be due to the use of the older/deteriorated seed sample in the earlier reported study as is evident from its physico-chemical characteristics.

The oil percentages for *L. leucocephala* (6.9%) and *C. holosericea* (5.6%) are rather low. Since efforts are being made to cultivate *L. leucocephala* plants, it is therefore hoped that larger plantations would provide more quantities of the seed. The utilisation of seeds could thus help in developing a new source of vegetable oil. With modern bio-genetic methodology it would be possible to evolve varieties with increased oil in their seeds. Such a pursuit is essentially called for.

As regards *Cassia holosericea* and other such perennial plants, there is a need to evolve facilities with which it is assured that oil rich seeds are produced by these plants after proper genetic experimentation. The development of such a germ plasm will help to launch a programme of achieving self sufficiency in the field of vegetable oils in the country.

References

1. Leucaena Promising Forage and Tree Crop for the Tropics, Report of an Adhoc Panel of the Advisory Committee on Technology Innovation, Board on Science and Technology for International Development, Office of Internal Affairs, National Academy Press, Washington, DC (1984).
2. S.M.H.Jafri, *The Flora of Karachi* (The Book Corporation, Karachi, 1966), pp.156.
3. M. Salim, M. Ashraf, S.A. Khan and M.K. Bhatty, Pak. j. sci. ind. res., **9**, 347 (1966).

- M. Arshraf, S.A. Khan and M.K.Bhatty, Pak. j. sci. ind. res., **14**, 399 (1971).
- M. J. Akhtar, S.A. Khan, M.I.Qureshi and M.K.Bhatty Pak. j. sci. ind. res., **15**, 218 (1972).
- S.A. Khan, M.I. Qureshi and M.K. Bhatty, Pak. j. sci. ind. res., **15**, 402 (1972).
- M. Salim, M. Sarwar, S.A. Khan and M.K. Bhatty, Pak. j. sci. ind. res., **20**, 305 (1977).
- M. Salim, D. Mohammad, M. Ahmad, M.Y. Raie, S.A. Khan and M.K. Bhatty, Pak. j. sci. ind. res., **24**, 21 (1981).
- S.A. Khan, D. Mohammad, M.J.I. Khan and M.K. Bhatty, Pak. j. sci. ind. res., **28**, 27 (1984).
- S.A. Khan, K.H. Khan, S. Zaka, I. Waheed, M.Y. Raie and M.K. Bhatty, Pak. j. sci. ind. res., **28**, 400 (1984).
- S.A. Khan, M. Nazir and M.K. Bhatty, Pak. j. sci. ind. res., **29**, 135 (1986).
- M. Rafiq, F.M. Chaudhry and S.A. Khan, Pak. j. sci. ind. res., **29**, 193 (1986).
- M. Rafiq, M. Hanif, F.M. Chaudhry and S.A. Khan, Pak. j. sci. ind. res., **30**, 367 (1987).
- M.S. Malik, M. Rafiq, A. Sattar and S.A. Khan, Pak. j. sci. ind. res., **30**, 369 (1987).
- A. Sattar, S. Mahmood and S.A. Khan , Pak. j. sci. ind. res., **30**, 631 (1987).
- A. Sattar, S. Mahmood and S.A. Khan, Pak. j. sci.. ind. res., **30**, 710 (1987).
- A. Sattar, M.Y. Ghanai and S.A. Khan, Pak. j. sci. ind. res., **31**, 139 (1988).
- A. Sattar, S. Mahmood and S.A. Khan, Pak. j. sci. ind. res., **31**, 743 (1988).

M.S. Malik, A. Sattar and S.A. Khan, Pak. j. sci. ind. res., **32**, 207 (1989).

4. S. Zaka, M.W. Akhtar, S.A. Khan and M.K. Bhatty, Proc. Pak. Acd. Sci., **23**, 167 (1986),
5. T.P. Hilditch, *The Chemical Constitution of Natural Fats.* (John Wiley & Sons, New York, 1965), 3rd rev. ed., pp. 228-236.
6. Munir Ahmed, F.M. Choudhry and Manzoor Ahmed Pak. j. sci. ind. res., **31**, 428 (1988).