

Lipid and Protein Constituents of *Crotalaria juncea* L.

Muhammad Akhtar Javed, Muhammad Saleem*, Muhammad Yamin
and Tanvir Ahmad Chaudri

Applied Chemistry Research Centre, PCSIR Laboratories Complex, Lahore-54600. - Pakistan.

Abstract – Seed lipids and proteins of *Crotalaria juncea* L were analyzed for fatty acids and amino acids respectively. Gas chromatographic analysis of the oil gave palmitic acid (16.01%), stearic acid (7.29%), oleic acid (14.41%), linoleic acid (54.44%) and linolenic acid (7.86%). The defatted seed cake contained all the essential amino acids except methionine and six non-essential amino acids.

Key Words – *Crotalaria juncea* L, Leguminosae, Fatty acid composition, Amino acid composition, Seed.

Introduction

Crotalaria juncea L. (Leguminosae), locally known as 'San', is a tall, green and stiff shrub (Parker, 1956). In the summer months it is cultivated in almost all the fertile areas of Pakistan. It bears yellow colored flowers in the month of July and the green pods on ripening contain ten to fifteen black seeds in them.

As a crop *Crotalaria juncea* L. is grown both as a green manure and for obtaining a fibre from the tall stalks. The fibre is used by the farmers for making ropes and strings for their house hold and farm needs while the seeds find use as an ingredient of feed.

Since *Crotalaria juncea* L. is a useful and regular crop and its seeds are abundantly available, it was decided to analyze the seeds with the view to find their chemical composition for useful application. It was particularly desirable to know the composition of the oil and the protein (Praveen and Madhuri, 1996) of the seeds as these constituents determine their utility. The present findings therefore describe the proximate analysis of the seeds and also the chemical composition of the oil and the proteins. The seeds used in the studies were procured from the Agriculture Research Institute, Faisalabad, and were authentic in character.

Experimental

Proximate Analysis of the seeds – The moisture, ash, oil and nitrogen contents of the seeds were deter-

mined by standard procedures (Jacobs, 1962) and are given in Table 1.

The physicochemical characteristics of the oil were determined according to the standard procedures (Paquot and Hautfenne, 1987) and are given in Table 2.

Fatty acid composition of the oil – The oil (1 g) was saponified with 0.5 N alcoholic potassium hydroxide (20 ml) and the fatty acids were liberated from the soap by H₂SO₄. These acids then were converted to their methyl esters by treatment with acidic methanol under reflux for four hours (Javed *et al.*, 1972). The methyl esters were then analyzed by gas

Table 1. Proximate analysis of *Crotalaria juncea* seed

1.	Moisture	10.85 %
2.	Ash	3.31 %
3.	Oil	4.22 %
4.	Protein	36.43 %
5.	Carbohydrates (by difference)	45.19 %

Table 2. Physicochemical properties of *Crotalaria juncea* L. oil

1.	Refractive index (Abbe's) (21°C)	1.47
2.	Specific gravity at 21°C	0.8832
3.	Color (Lovibond)	Y = 10.1, R = 0.3
4.	Acid value	2.7
5.	Saponification value	217
6.	Iodine value	119.71
7.	Maleic anhydride value	8.04

*Author for correspondence.

Table 3. Percent fatty acid composition of *Crotalaria juncea* L. oil

	Fatty acid	Percent
1.	Palmitic acid	16.01
2.	Stearic acid	7.29
3.	Oleic acid	14.41
4.	Linoleic acid	54.44
5.	Linolenic acid	7.86

chromatography using a 20% PEGS (Polyethylene glycol succinate) column at 198°C with a chart speed of 10 cm/min. Nitrogen was used as the carrier gas at a flow rate of 50 ml per minute. From the peaks area, the percentage composition of the acids was calculated which is given in Table 3.

Protein Analysis of 'San' Seed Cake

Acidic hydrolysis – The defatted San seeds powder (1 g) was hydrolyzed with 6 N hydrochloric acid (20 ml) for 24 hours in a sealed tube at 110°C. The contents were filtered and the solvent was removed

Table 4. Comparison of percent fatty acid composition of *San* seed and Soybean oils

	Palmitic	Stearic	Oleic	Linoleic	Linolenic
'San' seed oil	16.01	7.29	14.41	54.44	7.86
Soybean oil	11.90	4.40	24.00	51.90	7.80

Table 5. Percent composition of amino acids in *Crotalaria juncea* L. seed cake protein (expressed as g/100 g of the defatted cake)

	Essential amino acids	Percent
1.	Isoleucine	1.17
2.	Leucine	2.10
3.	Lysine	1.67
4.	Phenylalanine	0.92
5.	Threonine	0.88
6.	Tryptophan	0.53
7.	Tyrosine	0.78
8.	Valine	0.96
	Non-essential amino acids	Percent
1.	Alanine	2.12
2.	Arginine	2.72
3.	Aspartic acid	3.23
4.	Glutamic acid	9.45
5.	Glycine	1.53
6.	Proline	1.10

by using a rotary evaporator at 40°C.

Alkaline hydrolysis – The defatted *San* seeds powder (1 g) and a saturated solution of barium hydroxide were heated in an oil bath for 20 hours at 125°C. 1 N sulfuric acid was then added to the cold mixture till the formation of barium sulfate ceased. The amino acids thus liberated were filtered and dried at 40°C under vacuum, using a rotary evaporator (Pasha *et al.*, 1966).

Amino acid composition of *San* seeds – The amino acids were analyzed by high speed auto amino acid analyzer (EEL Model 193), using ion exchange chromatography with ninhydrin as developing agent. Basic amino acids were identified at pH 5.28, using sodium citrate buffer. Acidic amino acids were run at pH 4.25 at temperature 95-200°C. The percentage of amino acids determined is given in Table 5.

Results and Discussion

The analysis of the seeds of *Crotalaria juncea* L. has been carried out with a particular emphasis on the composition of oil and protein. As compared with other oil bearing seeds the percentage of oil is rather low but it can be seen from its composition that a very useful semi-drying oil can be obtained from this source. The oil is also rich in essential fatty acids whose composition can be compared with that of soybean oil (Craig and Murty, 1959).

These seeds have been shown to be a good source of proteins. Amino acid analysis of the seed protein shows that the protein contains all the essential amino acids except methionine, and many non-essential amino acids (Table 5). Essential amino acids are 30.86 % by weight of the total amino acids determined. The major essential amino acids in the seed meal are leucine, isoleucine and lysine, while the major non-essential amino acids are glutamic acid, aspartic acid, arginine and alanine. The seed cake however can only be consumed after proper evaluation, whether toxic compounds are present or not.

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(Accepted July 21, 1999)