

FATTY ACIDS OF INDIGENOUS RESOURCES FOR POSSIBLE INDUSTRIAL APPLICATIONS

Part XV. Fatty acid composition of the seed oils of *Withania coagulans* and *Withania somnifera*

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Seed oils from *Withania coagulans* (10.45) and *Withania somnifera* (23.6%) (N.O. Solanaceae) have been evaluated for their physico-chemical properties and fatty acid composition. The fatty acid composition, as determined by gas chromatography, revealed the presence of C_{12:0} (0.07%), C_{14:0} (0.09%, 0.14%), C_{16:0} (17.06%, 17.45%), C_{18:0} (1.10%, 3.71%), C_{18:1} (19.56%, 20.18%) and C_{18:2} (61.19%, 58.52%) fatty acids in *W. coagulans* and *W. somnifera* seed oils respectively.

Key words: *Withania coagulans*, *Withania somnifera*, Linoleic acid, Saponification.

INTRODUCTION

Withania coagulans and *Withania somnifera* (N.O. Solanaceae) are wild growing shrubs which are native to Pakistan, Afghanistan and India. Various parts of the plants have diverse medicinal attributes. *Withania coagulans* has, for instance, been commercially exploited to produce vegetable rennet [1]. Because of the pharmacological significance of the plants their seeds are easily available in the local market. It was, therefore, thought desirable to study the seed oils for their chemical composition with a view to utilising them usefully.

Detailed and authentic fatty acid composition of the seed oils of *Withania coagulans* and *Withania somnifera* has not so far been reported. Literature survey showed that the seed oil of *W. somnifera* was studied along with other seed oils and proteinous matter of other plants and some of the oils were found to contain high amounts of unsaturated fatty acids [2]. The seed oil of *Withania coagulans* was, however, also examined for some of its physico-chemical values only [3]. This sketchy information also warranted that the seed oils of *W. coagulans* and *W. somnifera* be examined for establishing their specific fatty acid composition.

The present communication, therefore, describes the fatty acid composition of the seed oils of *W. coagulans* and *W. somnifera* in continuation of earlier studies [6]. It has been observed that both seed oils have 80.75 and 78.70% over all unsaturates with linoleic acid as the predominant constituent at 61.19 and 58.52% respectively in *W. coagulans* and *W. somnifera*.

MATERIALS AND METHODS

All extracts were dried on anhydrous sodium sulphate. Oils. The dried seeds were crushed and extracted separately with redistilled hexane in a Soxhlet apparatus. The extracts were dried and filtered. The solvent was removed from the filtrates by a rotary evaporator to leave behind the oils as residues.

Physico-chemical examination of both oils was carried out according to standard methods [4]. The determined values along with the percentage yields of the oils are given in Table 1.

Table 1. Physico-chemical properties of seed oils of *W. coagulans* and *W. somnifera*.

Properties	<i>W. coagulans</i>	<i>W. somnifera</i>
Oil yield (%)	10.4	23.6
Specific gravity	0.9354	0.8957
Refractive index	1.4638	1.4660
Free fatty acids (%)	1.1	1.4
Acid value	2.1	2.8
Iodine value (Wiji's method)	136.8	158.2
Saponification value	210	216

Preparation of methyl fatty esters. The oils (2g each) were saponified separately by refluxing with alcoholic potassium hydroxide (33 ml; 0.5 N) for 3 to 4 hr on a water bath. At the end, most of the alcohol from the product was removed under vacuum and about 30 ml. of water were added to it. The aqueous solution was

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extracted with diethyl ether (3x20 ml) to remove the unsaponifiables. It was then acidified with dilute sulphuric acid and the liberated fatty acids were extracted with diethyl ether (3x20 ml). The organic extract was dried, filtered and the solvent was removed by a rotary evaporator. The recovered fatty acids were separately esterified by reacting with methanol in the presence of concentrated sulphuric acid and refluxing on water bath for 3 to 4 hr. Excess methanol was then distilled out and water (40 ml) was added and the mixture was extracted with diethyl ether (3 x 25 ml). The organic phase was dried, filtered and the solvent was removed to obtain the methyl esters of the fatty acids of the respective oils. These were checked by TLC and IR spectroscopy for the complete esterification of the fatty acids.

Gas chromatographic analysis. The methyl fatty acid esters were analysed for their chemical composition on a gas chromatography model Pye Unicam 204 series by using a column (length 1.5 m dia, 4 mm) of 15% DEGS on chromosorb at 180°. The detection was made with flame ionisation detector at 150° and nitrogen was used as the carrier gas with a flow rate of 40 ml/min. The injection port temperature was 200°. The constituent fatty acids, determined from the peak areas, are reported in Table 2.

Table 2. Fatty acid composition of the seed oils of *W. coagulans* and *W. somnifera* by gas chromatography.

Fatty acid	Percentage of fatty acid in oil of	
	<i>W. coagulans</i>	<i>W. somnifera</i>
C _{12:0}	0.04	0.07
C _{14:0}	0.09	0.14
C _{16:0}	17.06	17.45
C _{18:0}	1.10	3.71
C _{18:1}	19.56	20.18
C _{18:2}	61.19	58.52
Unsaturated	80.75	78.70
Saturated	19.29	21.37

DISCUSSION

Seeds of *Withania coagulans* were collected from the wild species of the plants found in the Razmic tribal area of NWFP while the seeds of *W. somnifera* were obtained from the species of the plant growing wild in and around Lahore District. The yields of oil by the solvent extraction method were 10.4 and 23.6% respectively; *W. somnifera*

seeds yielded almost double the amount of oil compared to the seeds of *W. coagulans*.

The physico-chemical values of both oils, as found out by standard methods [4], were within the range of good quality vegetable oils [5] Table. 1. Both oils had high iodine values (136.8 and 158.2) indicating their unsaturated character.

The fatty acid compositions of the oils were determined by gas chromatography after converting the liberated fatty acids to their methyl esters. The identification of the constituent fatty acids was made by running standard mixtures of methyl fatty esters under identical conditions with which the unknown mixtures were run and by comparing their retention times. Co-injection of standard methyl fatty esters was also carried out in order to further confirm the composition. The fatty acid profile of each oil as found out by GLC was recorded on a computing integrator and has been reported in Table 2.

The fatty acid composition indicated the presence of higher amounts of unsaturated fatty acids (80.75%, 78.70%) compared to saturated acids (19.29%, 21.37%). Linoleic acid (61.19%, 58.52%) was the predominant unsaturated fatty acid and palmitic acid (17.06%, 17.45%) was the major saturated acid present in the oils of *W. coagulans* and *W. somnifera* seeds respectively. This fatty acid profile is similar to the general composition pattern of the seed oils of the members of Solanaceae family [6e]. Both oils on the basis of their constituent fatty acids can thus be classed as unsaturated oils [5] and can find use as semi-drying oils in the industry.

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