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COMPOSITION OF LIPIDS FROM *Peganum harmala* AND *Thermopsis alterniflora* PROCESSING WASTES

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Lipids and lipophilic compounds are of great interest as bioactive additives in phytotherapy and cosmetics [1]. Wastes from processing medicinal plants are a cheap source of such compounds. Previous investigations of wastes from processing several drugs [2–4], regardless of the nature of the isolated drug, have shown that lipids and lipophilic compounds are concentrated during processing of the first crude extract (produced by a polar extractant) by a less polar solvent. The yield of lipids extracted from the resinous wastes can reach 90–98% of the waste mass.

Herein we communicate results from a study of processing wastes of aerial parts of *Peganum harmala* L. (Zygophyllaceae) and *Thermopsis alterniflora* Regel et Schmalh. (Fabaceae) and the biological activity of lipid concentrates obtained from them. Waste samples were obtained from the pilot plant of the Yunusov Institute of the Chemistry of Plant Substances, AS, RU. Lipids from reprocessed raw material of these plants were previously studied [5, 6].

The wastes were a dark-green resinous mass with a brown tint and herbaceous aroma. Preliminary analyses for the presence of lipids were carried out by common TLC methods on Silufol plates and plates with thin layers of silica gel [7] using comparison with authentic samples.

The results showed that the samples were rich in lipids and lipophilic compounds, which were observed previously in the starting material [5, 6]. Their qualitative composition including neutral lipids (NL), glycolipids (GL), and phospholipids (PL) in addition to carotinoids and chlorophyll pigments also turned out to be identical.

Next the waste samples were treated with $CHCl_3$. The lipid extracts were washed of ballast materials and separated using column chromatography. Components of individual lipid groups and lipophilic compounds in the isolated fractions were identified using TLC. The solvent systems for TLC were hexane:Et_2O:AcOH (90:10:1 and 70:30:1) for NL; $(CH_3)_2CO$:C_6H_6:H_2O (91:30:8) for GL, and $CHCl_3$:MeOH:NH_4OH (65:25:4) for PL.

The yields of lipids from the two samples were >50% of the waste mass. The ratio of NL to polar lipids (GL and PL) in processing wastes of *P. harmala* was 2:1; in *T. alterniflora* wastes, 1:1.

NL of the studied wastes consisted almost half of free fatty acids. The remainder consisted of triacylglycerides, esters of fatty alcohols, triterpenols, and sterols in addition to lipophilic compounds (carotinoids, hydrocarbons, fatty alcohols, phytosterols, and pigments). Lipids from *P. harmala* waste contained much more diacylglycerides, monoacylglycerides, and unidentified compounds than those of *T. alterniflora*. GL dominated the polar lipids.

GL contained digalactosyldiacylglycerides, sulfoquinovosyldiacylglycerides, and sterylglycosides and their fatty-acid esters. The principal component of the GL of the studied samples was monogalactosyldiacylglycerides.

The PL consisted of five components. The main ones were phosphatidylethanolamines, phosphatidylinositols, and phosphatidic acids. The minor ones were phosphatidylglycerines and phosphatidylcholines.

Unsaponified components and total fatty acids of all lipids were isolated from the two samples by alkaline hydrolysis under forcing conditions [7]. Quantitative analysis of the fractions showed that lipids from *T. alterniflora* wastes contained more unsaponified components (21.8%) than those from *P. harmala* wastes (17.0%).

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TABLE 1. Fatty-Acid Composition of Lipids from *Peganum harmala* and *Thermopsis alterniflora* Processing Wastes, GC, %

Acid	*P. harmala*	*Th. alterniflora*			
	total lipids	total lipids	NL	GL	PL
12:0	0.5	Tr.	Tr.	Tr.	Tr.
13:0	Tr.	Tr.	Tr.	–	Tr.
14:0	0.9	0.6	0.6	0.6	1.3
15:0	0.2	Tr.	Tr.	Tr.	Tr.
16:0	26.9	43.0	40.8	42.6	58.7
16:1	2.2	Tr.	Tr.	0.4	Tr.
17:0	0.6	Tr.	Tr.	Tr.	Tr.
18:0	4.0	5.6	4.6	6.0	3.9
18:1	12.6	10.3	6.3	13.0	12.5
18:2	22.6	18.5	19.3	16.9	11.6
18:3	29.5	21.0	22.4	20.5	12.0
20:0	Tr.	1.0	3.3	Tr.	
22:0		Tr.	2.7	–	–
$\Sigma_{sat.}$	33.1	50.2	52.0	49.2	63.9
$\Sigma_{unsat..}$	66.9	49.8	48.0	50.8	36.1

NL, neutral lipids; GL, glycolipids; PL, phospholipids. Tr. < 0.1%.

The composition of fatty acids of total lipids from both samples and acids isolated from NL, GL, and PL of *T. alterniflora* waste was studied using GC under the published conditions [8]. Table 1 lists the results. It can be seen that two thirds of the fatty acids from total lipids of *P. harmala* waste and one half of those from *T. alterniflora* were unsaturated acids. Among these, the fraction of 18:3 acid was greater than those of 18:2 and 18:1. The amount of principal saturated acid 16:0 in total lipids of *T. alterniflora* was 1.5 times greater than in those of *P. harmala*. The composition of acids according to separate groups from lipids of *T. alterniflora* waste showed that the PL were most enriched in 16:0 acid whereas both NL and GL had similar amounts of saturated and unsaturated acids.

Pharmacological tests indicated that the lipid concentrate from processing wastes of *P. harmala* had low toxicity and exhibited wound-healing activity whereas that from processing waste of *T. alterniflora* was practically nontoxic and had a positive effect on skin exchange processes.

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