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LIPIDS OF THE WASTES FROM THE PROCESSING OF *Aconitum leucostomum*

T. V. Khomova, S. D. Gusakova, A. I. Glushenkova, and R. M. Galyautdinova

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It has been established that the wastes from the production of the drug allapinin from the epigeal part of Aconitum leucostomum *consist of nonpolar and polar lipids with a high content of phospho- and glycolipids and free fatty acids.*

Continuing a study of the lipids from the wastes of the processing of plant biomass [1], we have investigated the composition of the resinous waste formed in the production of allapinin — a drug with an antiarrhythmic action [2]. The main industrial source of allapinin is the epigeal part of the wild perennial herbaceous plant *Aconitum leucostomum* Worosch., fam. Ranunculaceae.

In the production of allapinin by aqueous alcoholic extraction [3], unutilized solid waste (meal) and resinous waste (a mixture of compounds of nonbasic nature) are formed. Analysis has shown that the meal contains a small amount of lipids (0.24-0.26%) — while the yield of resinous waste consisting of a lipid complex amounts to 1.2-1.5% (on the weight of the initial raw material).

The identity of the qualitative compositions of the meal and of the resin was shown by TLC in systems 1-5; however, esters of sterols and of triterpenols with fatty acids (FAs), wax esters, and pigments of the carotene group were concentrated in the lipids of the meal, while the phospho- and glycolipids were present only in trace amounts.

The lipids of the resinous wastes were separated into individual fractions by the CC method (Table 1). As was to be expected [4], β-carotene was identified as the main component of the carotene group and the substances accompanying it were products of its oxidative transformations — violaxanthin, lutein, and neoxanthin. According to their mass spectra, the sterols contained β-sitosterol, stigmasterol, and campesterol. Among the glycolipids, mono- and digalactosyldiacylglycerols, stearyl glycosides and their esters with FAs, and sulfoglycolipids were identified by TLC in system 5 with specific revealing agents.

The composition of the phospholipids (% of their weight) was established colorimetrically: N-acylphosphatidylethanolamine — traces; phophatidylethanolamine — 7.0; phosphatidylglycerol — 17.6; phosphatidylcholine — 12.7; phosphatidylinositol — 18.1; phosphatidylserine — 15.9; lyso-phosphatidylcholine — 7.1; phosphatidic acid — 21.6.

Of the alkaloids accompanying the lipids, leuconine, lappaconitine, N-acylsepaconitine, leuconidine, leucofine, sepaconitine, aksine, and lappaconidine were identified.

After the alkaline hydrolysis of the lipids of the resinous waste and meal from *Aconitum leucostomum,* the unsaponifiables (11.2 and 45.8% of the weight of the wastes, respectively) and the sum of the FAs were isolated, the latter, according to the results of GLC and the mass spectrometry of their methyl esters, consisting of the components shown in Table 2. In the lipids of the resinous wastes, more than one third of the mixture of FAs consisted of the essential linoleic 18:2 acid, while in the meal the same proportion consisted of the 18:1 acid. Consequently, the resinous waste from the processing of the epigeal part of *A. leucostomum* is a concentrate enriched with polar lipids and, to a smaller degree, with free FAs.

The biological activity of the polar lipids and also of the pigments has been expounded fairly fully in the literature. Thus, antimutagenic, radioprotector, anticarcinogenic, and immunomodulating activities have been found in the carotenoids, and an antibacterial action in the chlorophylls [6].

Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan [IKhRV AN RUz], Tashkent, fax (3712) 8914 75. Translated from Khimiya Prirodnykh Soedinenii, No. 1, pp. 37-40, January-February, 1995. Original article submitted October 24, 1994.

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TABLE 1. Composition of the Resinous Waste from the Processing of the Epigeal Part of *Aconitum leucostomum*

Class of substances	Amount, % of the weight of the waste
Hydrocarbons	0.3
Carotenoids (calculated as β-carotene)	0.9
Esters of fatty acids with triterpenols and sterols	7.2
Ethyl esters of fatty acids	8.2
Triacylglycerols	Tr.
Free fatty acids + triterpenols	18.2
Sterols	6.0
Chlorophylls, including	0.4
chlorophyll a	0.083
chlorophyll b	0.077
pheophytin a	0.174
pheophytin b	0.056
Xanthophylls	0.5
Glycoplipids + transformed chlorophylls	17.0
Phospholipids + transformed chlorophylls	39.7
Alkaloids	1.6

TABLE 2. Composition of the Fatty Acids of the Meal and Resinous Wastes from the Processing of *Aconitum leucostomum*, % GLC

Acid	Resinous waste	Meal
12:0	0.1	1.4
13:0	Tr.	Tr.
X	0.3	Tr.
14:0	0.4	1.9
15:0	0.3	1.2
16:0	18.8	26.1
16:1	2.8	1.9
16:2	0.6	1.3
17:0	Tr.	Tr.
18:0	7.5	7.7
18:1	29.9	34.6
18:2	36.7	21.2
18:3	2.6	1.1
20:0	Tr.	Tr.
22:0	Tr.	1.6
Σ_{sat}	27.4	39.9
Σ_{unsat}	72.6	60.1

The phospho- and glycolipids exhibit immunity-stimulating adjuvant properties, facilitate the transport of nutrient substances through the skin, restore disturbed membrane functions, activate or modify the activities of enzymes [7], and possess pronounced surface-active properties [8]. An HIV-inhibiting activity has been found in glycolipids with sulfo acids [9].

The facts given above permit the waste from *A. leucostomum* to be recommended as a bioadditive in domestic chemical products and phytocosmetics. At the present time, Guzal shampoo containing a preparation of the lipids from *A. leucostomum* wastes is being manufactured industrially.

EXPERIMENTAL

The conditions for recording UV and mass spectra and for CC, the methods for extracting the lipids and for isolating and detecting in TLC individual lipid classes, GLC, and the isolation and identification of the fatty acids have been described in [10].

The colorimetry of the phospholipids was conducted on an FÉK-M instrument.

Samples of *A. leucostomum* wastes after allapinin had been obtained from the plant biomass were selected in the experimental factory of IKhRV AN RUz.

TLC was conducted on silica gel L 5/40 with the addition of 10% of $CaSO_4$ in the following systems: 1) hexane; 2) hexane—diethyl ether (9:1); 3) (7:3); 4) (7:8); and 5) $CHCl_3$—CH_3OH—NH_4OH (65:25:5).

Carotenoids. UV spectrum (ethanol, nm): 425, 455, 480 (β-carotene); 417, 441, 469 (violaxanthin); 418, 438, 466 (neoxanthin); and 421, 446, 474 (lutein) [11].

Chlorophylls. UV spectrum (hexane, nm): 663 (chlorophyll a); 645 (chlorophyll b); 668 (pheophytin a); 655 (pheophytin b) [12].

The total alkaloids were estimated quantitatively by the method of [13], except that the amount of alkaloids in the final stage was determined in the form of a dry residue gravimetrically. The alkaloids were identified by their TLC behavior on Sorbsil plates (10 × 15 cm, Krasnodar) in the chloroform—benzene—diethylamine (10:40:1.4) system with detection in UV light at 254 nm. The individual compounds isolated previously from *A. leucostomum* in the laboratory of alkaloid chemistry of IKhRV AN RUz [14] were used as standards.

REFERENCES

1. T. V. Khomova and S. D. Gusakova, Maslo-zhir. Prom-st., No. 10, 30 (1981).
2. F. N. Dzhakhangirov and F. S. Sadritdinov, Dokl. Akad. Nauk UzSSR, No. 3, 46 (1985).
3. A. Z. Sadikov and T. T. Shakirov, Khim. Prir. Soedin., 91 (1988).
4. T. W. Goodwin and E. I. Mercer, An Introduction to Plant Biochemistry (2nd Ed.), Pergamon, Oxford (1982) [Russian translation, Mir, Moscow (1986), Vol. 1, p. 115].
5. E. P. Feofilova, Prikl. Biokhim. i Mikrobiol., **30**, No. 2, 181 (1994).
6. M. D. Mashkovskii, Drugs [in Russian], Meditsina, Moscow, Vol. 2 (1984), p. 421.
7. Yu. M. Krasnopol'skii, I. I. Gol'bets, G. A. Sennikov, and V. I. Shvets, Khim.-Farm. Zh., No. 7, 13 (1981).
8. J. L. Parra, J. Guinea, M. A. Manresa, and M. J. Robert, J. Am. Oil Chem. Soc., No. 1, 141 (1989).
9. PCT Patent No. 91/02521; Byul. ISM, No. 3, Issues 8, 10 (1992).
10. T. V. Khomova, S. D. Gusakova, A. I. Glushenkova, and A. P. Shlyapnikova, Khim. Prir. Soedin., 707 (1984).
11. F. H. Foppen, Chromatographic Reviews, **14**, No. 3, 18 (1971).
12. Handbook on Methods of Investigation, Technochemical Control, and the Accounting of Production in the Oils and Fats Industry [in Russian], VNIIZh [All-Union Scientific–Research Institute of Fats], Leningrad, Vol. 1 (1967), p. 707.
13. A. U. Makhkamova, É. V. Safonova, A. Z. Sadikov, E. K. Dobronravova, and T. T. Shakirov, Khim. Prir. Soedin., 436 (1989).
14. V. V. Tel'nov and S. K. Usmanova, Khim. Prir. Soedin., 538 (1992).