Chemistry of Natural Compounds, Vol. 38, No. 5, 2002

LIPIDS OF *Ricinus communis* SEEDS

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UDC 547.915

Lipids of Kazachok castor seeds were studied. The compositions of neutral lipids of the benzine extract and of the fatty acids of neutral and polar lipids were found. The principal acids were palmitic, oleic, linoleic, and 12-hydroxyoctadec-9-enoic.

Key words: castor, neutral and polar lipids, ricinolic acid, triacylglycerides, fatty acids and sterols.

Common castor, *Ricinus communis* L., belongs to the Euphorbiaceae family (spurges). It is a perennial in tropical and subtropical countries and an annual in countries with a temperate climate. It is cultivated as an annual [1].

Castor oil is prepared by cold and hot pressing. It differs from other plant oils in its solubility in alcohol and high density and viscosity. Therefore, it is a good lubricant and is used in the manufacture of aviation coatings, paints, rubber, soap, and glycerine.

The oil is a very valuable raw material for the production of synthetic fragrances owing to the presence of ricinolic acid [2]. The oilcake is used as a fertilizer.

Castor oil in medicine is used as a laxative and is included in Vishnevskii ointment, balsams applied to burns and sores, Camphocin liniment, and is recommended for rheumatism and arthritis [3].

Chemical studies of castor-oil lipids have established mainly the fatty-acid and triacylglyceride compositions. These include ricinolic (12-hydroxyoleic) acid, the content of which reaches 90.0%. Therefore, the main component of the oil (68.2%) is a triacylricinoleyl [4].

We studied in detail lipids of Kazachok castor with a very high oil content that was brought from Krasnodar territory for cultivation in the Central Asian district [5]. Neutral lipids (NL) were isolated from ground seeds by extraction first with benzine (bp 75-80°C) and then with diethylether. The yield of the benzine extract was 26.6%; of the ether, 17.2%.

We isolated polar lipids (PL) from the remaining pulp by extraction with a mixture of $CHCl_3$ and MeOH (2:1, v/v).

The last extract was purified of nonlipid components by washing with aqueous $CaCl_2$ (0.05%). The content of the PL was 0.6% of the seed mass.

The extracts were analyzed by TLC on silica gel using solvent system 1. The benzine extract contained three principal components and several minor ones; the ether extract, one principal and two minor ones. Lipids of the benzine extract included a larger number of compounds. Therefore, they were separated into classes by column chromatography over silica gel. The eluent was benzine with an increasing concentration of diethylether. This isolated 42 fractions of compounds that were identified by TLC using solvent systems 1-3 in comparison with model compounds and qualitative reactions.

Tocopherols were found to be present by analytical TLC on silica gel using $CHCl_3$ with development of the plates by Emmery—Engler reagent [6].

The remaining lipid classes were developed by 50% aqueous H_2SO_4 and subsequent heating. The contents of the individual lipid classes were determined gravimetrically.

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0009-3130/02/3805-0413$27.00

Lipids	Content, mass %
Hydrocarbons	0.9
Sterol esters of fatty acids	0.6
Triacylglycerides of common fatty acids	0.7
Tocopherols + unidentified components	0.3
Triacylglycerides-1	1.5
Free fatty acids	1.5
Triacylglycerides-2 + sterols	31.6
Triacylglycerides-3	53.1
Unidentified components	9.8

TABLE 1. Composition of Common Fatty Acids of Neutral and Polar Lipids of Castor Seeds

Acid	Content, GC, mass %	
	neutral lipids	polar lipids
12:0	0.4	4.4
14:0	0.4	4.3
16:0	10.2	23.1
16:1	0.8	1.0
17:0	-	1.3
18:0	8.4	11.6
18:1	34.0	15.6
18:2	40.5	24.8
18:3	5.3	3.9
Unidentified	-	10.0
Σ_{sat}	19.4	44.7
Σ_{unsat}	80.6	45.3

It can be seen that the principal lipid mass (53.1%) consists of triacylglycerides-3 (TAG-3), which contain three ricinolic acids.

Triacylglycerides-2 (TAG-2) with two ricinolic acids make up 31.6%; triacylglycerides-1 (TAG-1) with one acyl, 1.5% of the mass of the benzine extract.

TAG-3 are the principal components of the ether extract; TAG-1 and TAG-2, minor ones.

Glycolipids (GL) in the PL were identified by TLC using solvent system 4. Development of plates with α-naphthol revealed the principal components: sterolglycoside esters, sterolglycosides, cerebrosides, and digalactosyldiglycerides [7].

Phospholipids (PL) were analyzed by two-dimensional TLC on silica gel first using solvent system 5 and then 6 in the second direction. Bands of compounds were developed using ninhydrin and Dragendorff's and Vaskovskii's solutions [7].

The PL contained phosphatidylcholines, phosphatidylethanolamines, phosphatidylserines, and phosphatidylinosites, the last of which was predominant. Traces of phosphatidic acid were observed.

Fatty acids of NL of the benzine extract and PL were isolated by base hydrolysis. They were analyzed after methylation by TLC on silica gel using solvent system 3. Three bands of methyl esters (ME) were found: ME of common fatty acids, ME of monohydroxyacids, and traces of ME of dihydroxyacids. Column chromatography over silica gel separated the fatty-acid ME into three individual groups, the contents of which were 25.0, 74.2, and 0.8%, respectively.

Hydroxyacids were not observed in fatty acids of the PL. The composition of the ME of common fatty acids was established by GC (Table 1).

Table 1 shows that the fatty acids of the benzine extract have a higher degree of unsaturation than those of the PL, where the saturated and unsaturated fatty acids are present in practically equal amounts.

The 18:1 and 18:2 acids dominate the unsaturated fatty acids in both the NL and PL. The principal saturated acid is 16:0.

EXPERIMENTAL

GC was performed on a Chrom-5 instrument in a column packed with 5% Reoplex on W-W at 190°C and N_2 flow rate 30 mL/min.

Analytical TLC was carried out on silica gel L 5/40 with 5% gypsum activated at 110°C and on Silufol plates; column chromatography of NL and total ME, over silica gel L 100/250.

The solvent systems hexane—diethylether (4:6, 1; 8:2, 2; 1:1, 3), $CHCl_3$—$(CH_3)_2CO$—CH_3OH—CH_3CO_2H—H_2O (65:25:10:10:3, 4), $CHCl_3$—CH_3OH—NH_4OH (65:25:5, 5), and $CHCl_3$—CH_3OH—CH_3CO_2H—H_2O (14:5:1:1, 6) were used.

Lipids were hydrolyzed and fatty acids were isolated by the literature methods [8].

Fatty acids were methylated with diazomethane in diethylether. Diazomethane was prepared as before [9].

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