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LIPIDS AND LIPOPHILIC COMPONENTS FROM SEEDS OF SOME FRUIT PLANTS

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Lipids and lipophilic components from seeds of grape seeds and apricot, almond, and peach pits were studied. The compositions of fatty acids and unsaponified oil compounds were established.

Key words: *Armeniaca*, *Amygdalus*, *Persica*, Rosaceae, *Vitis*, Vitaceae, seed oils, fatty acids, unsaponified compounds.

The goal of the present research was a detailed study of the composition of oils from pits of apricot (*Armeniaca*), almond (*Amygdalus*), peach (*Persica*) (all Rosaceae), and grape seeds (*Vitis*, Vitaceae) [1], which are multi-ton wastes of preserves and viticulture plants.

Almond oil is well-known in folk medicine as a laxative for constipation [2] and as a treatment for chronic gastritis, cholitis, chronic bronchitis, and earaches [3]. It is used in modern medicine as an ointment for wounds and for treating myositis [4]. Almond oil has a softening action and nutrititive effect on skin, which explains its use in the production of cosmetics. Furthermore, almond oil has certain sedative and analgesic properties and is essential as a solvent for preparing oil solutions of certain drugs [5, 6].

Oils of the two other stonefruits are substitutes for almond and are used analogously.

Grape oil is used as a condiment and in the production of margarine and cosmetics [7].

Seeds of these plants have a high oil content. Thus, seeds of *Armeniaca* contain 29-58% oil [8, 9]; *Amygdalus*, 41-62 [10-13]; *Persica*, 20-60 [12, 14]; and *Vitis*, 15.8-16.3 [15].

We studied oils supplied by Effectiv Oil plant in Kokand that were produced by cold pressing. Table 1 lists their physicochemical properties.

The seed oils had about the same densities. Grape oil had the highest density because of the higher content in it of linoleic acid. This was also confirmed by the highest index of refraction.

Peach oil had a high content of unsaponified compounds. This has been noted previously [14].

Grape oil (1.10 mg KOH) had the lowest content of free fatty acids (FFA).

Next, the fatty-acid (FA) compositions of the isolated oils were determined after hydrolysis (Table 2).

It was found that the FA compositions of the studied oils were qualitatively similar. The quantitative compositions of three oils (almond, apricot, and peach) were considered oleic-containing (main component 18:1 acid, 53.4-61.4%); grape oil, linoleic-containing (18:2, 65.6%).

The total unsaturation in previously studied *Armeniaca* species was 97%; content of 18:1 acid, 60-79%; 18:2, 18-32% [14, 16-18]. These parameters in *Amygdalus* species were 87.3-97.0, 21.0-84.0, and 11.9-49.0%, respectively [5, 10, 12, 14], which is explained by the numerous varieties of this species. The values in *Persica* species were 88.0-91.9, 61.2-85.0, and 16.4-30.7%, respectively [12, 14].

The high content of oleic acid in the first three species approaches that in olive oil, the main component of which is triolein. Olive oil is widely used in industry for long-term preservation of products. According to the literature, the triolein content in seed oil of *Amygdalus* is 31% [19]; the total content of triply unsaturated triglycerides in plants of the genus *Amygdalus*, 72.3-87.6 [10].

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TABLE 1. Physicochemical Properties of Studied Oils

Property	Grape	Almond	Apricot	Peach
Density, g/cm^3	0.9248	0.9170	0.9180	0.9190
Refraction coefficient	1.475	1.469	1.473	1.472
Acidity number, mg KOH	1.10	1.64	3.21	1.83
Unsaponified compounds, %	0.9	0.6	0.8	1.3

TABLE 2. Fatty-Acid Composition of Studied Oils, GC, mass %

Acid	Grape	Almond	Apricot	Peach
14:0	0.2	0.4	Tr.	0.2
16:0	8.0	11.0	5.2	9.9
16:1	0.7	1.2	1.3	1.9
18:0	5.1	3.9	5.5	5.7
18:1	20.4	54.5	61.4	53.4
18:2	65.6	29.0	26.6	28.9
$\Sigma_{sat.}$	13.3	15.3	10.7	15.8
$\Sigma_{unsat.}$	86.7	84.7	89.3	84.2

TABLE 3. Composition and Content of Aliphatic Alcohols, Triterpenols, and Sterols of Studied Oils, GC, mass %

Component	Grape	Almond	Apricot	Peach
Aliphatic alcohols:				
16:0	1.3	1.6	1.2	4.6
18:0	5.3	5.4	2.6	9.3
20:0	5.6	3.3	1.3	5.3
22:0	4.2	2.1	1.5	5.9
24:0	6.1	1.5	1.5	3.6
26:0	8.1	1.8	1.6	4.5
28:0	6.5	5.1	3.8	5.3
Triterpene alcohols:				
β-Amyrin	5.0	} 12.1	Tr.	9.0
α-Amyrin	4.9			7.7
Sterols:				
Campesterol	Tr.	Tr.	Tr.	1.3
Stigmasterol	7.8	4.7	5.0	2.8
β-Sitosterol	45.2	62.4	81.5	40.7

The composition of the isolated unsaponified compounds was determined by TLC and CC. These compounds were hydrocarbons and aliphatic and triterpene alcohols and sterols with high biological activity. Thus, aliphatic alcohols of the even series C_{22}-C_{26} in several experiments exhibited high reparative activity [20]. Sitosterols prevent the development of atherosclerosis and are an intermediate in the synthesis of hormones and other biologically active compounds [21]. The reaction of sterols with phospholipids stabilizes cell membranes and controls their permeability [22]. Triterpenes possess antitumor, anti-ulcer, antispasmodic, antibacterial, antihypercholesterolemic, and other types of activity [23, 24].

Various researchers have reported total tocopherols in the genera *Persica* and *Amygdalus* of 20.5-39.7 mg%, mainly the α- and γ-isomers [12, 25]. Determination of minor components of unsaponified components was beyond the scope of the present investigation.

The component composition of the main classes of unsaponified compounds was determined by GC (Table 3).

TABLE 4. Overall Composition of Unsaponified Compounds of Oils, mass %

Component	Grape	Almond	Apricot	Peach
Carbohydrates	15.3	9.5	8.2	19.3
Aliphatic alcohols				
16:0–28:0	30.1	17.9	11.9	28.0
Triterpenols:				
β-Amyrin	4.1	}10.6	Tr.	6.4
α-Amyrin	3.9			5.6
Sterols:				
Campesterol	Tr.	Tr.	Tr.	0.9
Stigmasterol	6.3	4.0	4.3	2.1
β-Sitosterol	37.0	54.0	71.8	30.3
Unidentified	3.3	4.0	3.8	7.4

The main aliphatic alcohols of the Rosaceae representatives were C_{18} and C_{28}; of grape, C_{26}. The main component in sterols of the studied oils was β-sitosterol. The main component in total sitosterols in one of the unassigned species of *Amygdalus* and *Armeniaca vulgaris* was also β-sitosterol [13, 26].

Table 4 lists the total composition of the unsaponified compounds.

The results indicated that the studied oils contained a significant quantity of biologically active components, essential fatty acids and aliphatic and cyclic alcohols, and may be promising raw materials for the food, pharmaceutical, and cosmetics industries.

EXPERIMENTAL

The index of refraction, density, acid number, and content of unsaponified compounds were determined as before [27]. Hydrolysis of oils and isolation of FA and their methylation were carried out by the literature method [28]. GC of FA methyl esters and alcohols was performed on a Chrom-5 instrument using a steel column (2.5 m) packed with Reoplex-400 (5%) on Inerton-N-AW (0.16-0.20 mm) at 190°C and N_2 flow rate 30 mL/min for FA methyl esters and a glass column (1.2 m × 3 mm) packed with Inerton-Super (5% OV-1, 0.16-0.20 mm) at 220-260°C for alcohols.

TLC of unsaponified compounds was carried out over silica gel L 5/40 with 10% gypsum using solvent systems hexane:diethylether (4:1 and 1:1); column chromatography, over silica gel L (160/250).

The contents of each group of unsaponified compounds and separate components were established using a combination of CC and GC of the total unsaponified compounds.

CC was performed over silica gel with elution by hexane with concentrations of diethylether gradually increasing from 0 to 100%.

Unsaponified compounds were identified as triterpenols and sterols using the Burchard–Liebermann reaction and authentic samples of alcohols obtained by us previously from natural sources.

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