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AMINO-ACID AND MONOSACCHARIDE COMPOSITIONS OF *Salvia officinalis* LEAVES

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The genus *Salvia* numbers about 600 species over the whole world [1]. According to the USSR SP, XIth Ed., the official plant raw material consists of *S. officinalis* leaves [2]. Greater than 35 preparations based on biologically active compounds (BAC) from salvia leaves are registered in the Russian Federation and Ukraine. Of these, 11 are of domestic origin. However, only isoprenoid and phenolic compounds are used in the pharmaceutical industry [3].

Because amino acids and monosaccharides affect the bioavailability and general pharmacotherapeutic effect of plant extracts and preparations based on them, our goal was to determine the amino-acid and monosaccharide compositions of *S. officinalis* leaves.

Leaves of *S. officinalis* were purchased in a pharmacy (Ser. 130409, ZAO Lektravy, Zhitomir) and analyzed according to requirements of the USSR, SP, XIth Ed. [2] using exhaustive extraction with EtOH (70%).

Preliminary chromatographic studies of the qualitative amino-acid composition were performed using descending paper chromatography on Filtrak No. 4 and *n*-BuOH:AcOH:H_2O (4:1:2). A standard set of amino acids (TU 6-09-3147-83, 0.1%) was used for comparison. Chromatograms were treated with ninhydrin solution in acetone and dried in a drying cabinet at 60–80°C. Amino acids were identified by comparing R_f values with those of authentic samples in parallel chromatograms. Five amino acids, Asp, Glu, Ser, Tyr, and Phe, were identified (Table 1).

The qualitative and quantitative analyses of free and bound amino acids in *S. officinalis* leaves were carried out using HPLC (Agilent Technologies, model 1100). The quantitative determination used standard solutions of amino acids (TU 6-09-3147-83), an AA chromatography column (200 × 2.1 mm), a guard column, mobile phase solution A [NaOAc, 20 mM; Et_3N (0.018%), adjusted to pH 7.2 with AcOH (1–2%); THF (0.3%)]; and solution B [CH_3CN, 40%; MeOH, 40%; NaOAc, 20%, 100 mM, adjusted to pH 7.2 with AcOH (1–2%)], and flow rate 0.450 mL/min. The compressibility of solution A was 50×10^{-6} bar; solution B, 115×10^{-6} bar. The column temperature was 40°C. A UV detector was used.

Bound amino acids were determined by hydrolyzing the alcohol extract (0.1 g, accurate weight) in an ampul (Pyrex glass) with HCl solution (6 M) taken in a 1:200 ratio. Air was pumped out. The ampul was sealed, placed in a thermostat at 80°C, and hydrolyzed for 24 h. The ampul was opened. The contents were centrifuged and filtered through a membrane filter (0.45 μm) into a vial for analysis. Table 1 presents the results of the qualitative determination of the composition and the quantitative contents of free and bound amino acids in salvia leaves.

The study of the amino-acid composition of salvia leaves identified 11 free and 13 bound amino acids, six of which were essential, threonine, valine, isoleucin, leucine, phenylalanine, and arginine. Table 1 shows that tyrosine, serine, glutamic and aspartic acids, and phenylalanine dominated in *S. officinalis* leaves. The content of free amino acids was 0.015%; of bound, 0.041%.

Preliminary identification of monosaccharides was performed using descending paper chromatography and *n*-BuOH:AcOH:H_2O (4:1:2) with authentic samples of neutral monosaccharides. Chromatograms were treated with anilinium acid phthalate solution and heated to 105–100°C. Glucose, galactose, and rhamnose were identified in the extract. Monosaccharides were analyzed on an Agilent Technologies model 1100 chromatograph attached to a G1379A micro vacuum degasser, a G1311A low-pressure gradient quaternary pump, a G1313A autosampler, a G1316A thermostatted column compartment, and a G1362A refractive index detector. A carbohydrate analytical chromatography column (7.8 × 300 mm, Supelcogel-C610H) was used. The mobile-phase flow rate was 0.5 mL/min; eluent, aqueous H_3PO_4 (0.1%); operating pressure, 33–36 kPa; column thermostat temperature, 30°C; sample volume, 5 μL. The refractive index detector was set to the 1.0 measurement scale with scan time 0.5 s. Monosaccharides were identified using retention times of standards.

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TABLE 1. Amino-Acid Composition of *Salvia officinalis* Leaves

Amino acid	Amino-acid content, mg per 100 g raw matl.		Amino acid	Amino-acid content, mg per 100 g raw matl.	
	free	bound		free	bound
Asp	1.37	4.35	Cys	0.0	5.53
Glu	1.66	4.72	Val	0.94	1.25
Ser	6.74	7.41	Phe	1.20	1.35
Gly	0.44	0.41	Ile	1.04	1.87
Thr	0.84	1.51	Pro	0.23	0.52
Arg	0.0	5.39	Leu	1.01	1.19
Tyr	14.40	5.35			

Three monosaccharides, glucose (167.8 mg/100 g raw matl.), galactose (18.4), and rhamnose (238.4) were identified in salvia leaves. The content of free monosaccharides in salvia leaves was 0.42%.

Thus, leaves of *S. officinalis* contained 11 free and 13 bound amino acids, six of which were essential (threonine, valine, isoleucine, leucine, phenylalanine, and arginine) and three monosaccharides (glucose, galactose, rhamnose).

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