CHARACTERIZATION OF THE POLYSACCHARIDES OF *Beta vulgaris*

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In the industrial processing of sugar beet, a considerable amount of waste – beet pulp – is formed. It contains about 20% of gelling polysaccharides, pectin substances.

We have previously published information on the isolation of polysaccharides (I-III) [1]. In the present communication we give their characterization. The preparation (I) isolated from fresh sugar beet pulp with a yield of 55% and the preparations (II) and (III) isolated from dry sugar beet pulp with yields of 50% and 70%, respectively, consisted of light yellow powders which were insoluble in organic solvents and soluble to a limited extent in water. The relative viscosities of 0.5% aqueous solutions of polysaccharides (I-III) were, respectively, 2, 1.7, and 1.5. The specific rotations (c 1.0; H_2O) were: (I) +134°; (II) +105°; (III) +144°. The quantitative characteristics obtained by the titrimetric method [2] were as follows (%):

	I	II	III
Free carboxy groups, C_f	14	14.2	10
Esterified carboxy groups, C_e	5.35	4.8	9
Degree of methoxylation	27.6	25.3	47.3
Methoxy component	3.7	3.3	6.2
Uronide content	74	43	60

To determine the monosaccharide compositions, samples (I-III) were subjected to complete acid hydrolysis. The hydrolysates, after neutralization with barium carbonate and filtration, were evaporated to minimum volume. Ethanol was added to the concentrated hydrolysates in ratios of 1:5-10. The resulting precipitates (barium salts of galacturonic acid) were separated off by centrifugation. The ethanolic solutions (neutral sugars) were evaporated to the syrupy state and were analyzed by GLC. For the GLC analysis, the monosaccharides were converted into the corresponding aldononitrile acetates [3]. The compositions and ratios of the neutral sugars of samples (I-III) determined by the GLC method are given below:

Sample	Rhamnose	Arabinose	Xylose	Mannose	Glucose	Galactose
I	2.4	5.7	—	—	1	2.4
II	1.4	—	—	—	—	1
III	39	2.1	1	Сл.	2.1	32

As we see, the ratio of rhamnose and galactose was close to 1:1 for all three preparations.

To determine the molecular masses we used gel filtration [4] on a column of Sephadex G-100 calibrated with standard samples of dextrans having molecular masses of 4000, 10,000, 20,000, and 40,000. As a result of gel chromatography it was shown that all three samples of pectins were polydisperse (the curves of the gel filtration of the polysaccharides showed from two to five peaks). The molecular masses of the samples varied correspondingly: (I) – 6900-40,000; (II) – 5000-34,600; (III) – 6000-34,000, i.e., in all the polysaccharides fractions with lower molecular masses predominated.

Thus, the polysaccharides obtained from the fresh and dry pulp have similar ratios of rhamnose and galactose (≈1:1) and molecular weights but differ by the ratios of the other neutral sugars and the uronic anhydride content.

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POLYSACCHARIDES OF *Viburnum opulus*

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We have investigated the fruit and leaves of *Viburnum opulus* L. (European cranberry bush) collected in the environs of the village of Goldino, Mikhailov Region, Ryazan'Province.

The European cranberry bush contains a number of biologically active substances [1] and is used in medical practice [1, 2], while its fresh fruit is used as a food [2, 3]. However, the chemical composition of the fruit and, particularly, of the leaves of the cranberry bush have been studied inadequately, and the water-soluble polysaccharides (WSPSs) have not previously been discussed.

The air-dry raw material (moisture content of the fruit 10.2-11.4%, and of the leaves 9.4-10.0%) previously twice purified with ethanol (1:10) for 2 h was extracted with hot water at 90-95°C (1:20) for 1.5 h. The aqueous extract was filtered, evaporated, and treated with 96% ethanol (1.5 volumes). The precipitate of WSPSs was separated off and was washed with ethanol and acetone. The yield of polysaccharides (PSs) from the green fruit was 5.8%, from the ripe fruit 2.5%, and from the leaves collected in the ripe-fruit phase 3.7%. The ash contents of the PSs of the fruit (6.8-7.1%) and of the leaves (18.70%) were determined by burning samples of them in a muffle furnace at 600°C.

The demineralization of the PSs was carried out by reprecipitating aqueous solutions with acidified ethanol, dialysis through a semipermeable membrane, and treatment with KU-2 cation-exchange resin (H^+ form). The ash content of the demineralized WSPSs was 0.4-0.6%. The amounts of uronic anhydride in the PSs of the fruit (unripe, 88.6%, ripe, 85.9%) and of the leaves (75.0%) were established by complexonometric titration [4].

The demineralized WSPSs (0.1 g) were dissolved in 1 N H_2SO_4 (5 ml) and were hydrolyzed on the boiling water bath for 9 h. The resulting hydrolysate was neutralized with $BaCO_3$, filtered, and evaporated, and the residue was studied by descending paper chromatography in the butan-1-ol–pyridine–water (6:4:3) system at 21-23°C for 40-45 h (Leningrad type M ["slow"] paper, density 80 g/m^2). The monosaccharides were revealed with aniline phthalate at 105-110°C for 10 min.

It was established that the PSs of the fruit of the European cranberry bush are composed of the residues of seven monosaccharides: D-galacturonic acid, D-galactose, D-glucose, L-arabinose, D-xylose, and L-rhamnose, and one unidentified monosaccharide present in traces and chromatographically more mobile than L-rhamnose, while the WSPSs of the leaves contained, in addition, another unidentified monosaccharide more mobile than D-xylose.

The neutral sugars galactose, glucose, arabinose, xylose, and rhamnose were determined by the direct densitometry of the chromatograms in a type 3 CS integrating automatic microdensitometer (Joyce-Loebl) and their ratio in the WSPSs of the unripe fruit was found to be 2:0.9:2.2:1.1:1, respectively, in the ripe fruit 5.8:1.2:6.3:1.6:1, and in the leaves 6.3:4.6:5.4:1.3:1. The results obtained permit the PSs of the fruit and leaves of the European cranberry bush to be assigned to the class of pectin substances.

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