BRIEF COMMUNICATIONS

POLYSACCHARIDES OF Beta vulgaris

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Common beet Beta vulgaris is used in large amounts in the preserving industry and in general nutrtion [1, 2]. Its chemical composition has been given in a number of publications [3, 4]. Calculated on the crude mass, common beet contains (%): sugar, 10.0; cellulose, 0.8; pectin substances, 1.2; hemicelluloses and other carbohydrates, 1.5; nitrogen-containing substances, 0.2; and ash, 1.0. Thus, polysaccharides form a considerable part of this root crop, but there is comparatively little description of them in the literature.

A tendency to the complex processing of this raw material and the considerable amount of by-products concentrated in the enterprises of the good industry make the study of its polysaccharides desirable. Below we give the characteristics of the polysaccharides isolated by successive extraction from the beet mass under conditions described previously [5-7].

Characteristics of the Pectin Substances of Common Beet:

Molecular mass	8100
Free carboxy groups, %	12.10
Methoxylated carboxy groups, %	2.10
Acetyl groups, %	0.40
Degree of esterification, %	14.85
Methoxylated groups	1.45
Total amount of carboxy groups	14.14

Monosaccharide composition of a hydrolysate of the pectin substances of common beet (weight fractions, %):

Uronic acids	55.0
Galactose	13.2
Glucose	7.3
Arabinose	1.4
Xylose	11.5
Rhamnose	11.5

Thus, the pectin of common beet has a low degree of methoxylation and it possesses a smaller gelling capacity than apple and citrus pectin. The high content of carboxy and acetyl groups promotes the binding of metal cations. Uronic acids predominate among the components of a hydrolysate of beet pectin, their weight fraction amounting to 55%. In different ratios to them are the accompanying galactose, glucose, arabinose, xylose, and rhamnose (Table 1).

The HMCs were extracted with 6 and 24% solutions of potassium hydroxide from common beet after the elimination of the pectin substances. The following were identified in a hydrolysate by paper chromatography: glucuronic acid, galactose, arabinose, xylose, and glucose. According to these results, the cell walls of the beet contain not only pectin but also a xylan and other heteropolysaccharides formed from galactose residues. The presence of a xyloglucan and an arabinan is probable [8] (see Table 1).

According to the result of fractionation, the polysaccharides of the HMCs were inhomogeneous and consisted of a set of acidic products differing by the amounts of uronic acids and the ratios of the neutral monomers (Table 2). The presence of a large amount of uronic acids showed that the alkaline extract contained an acidic component of the type of pectin substances. The neutral fractions of the HMCs contained mainly a xyloglucan in fairly pure form. The presence of an arabinoglucuronoxylan and also a trace of pectin substances in the buffer fractions could be assumed. The alkaline fractions presumably contained a xylan.

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TABLE 1. Monosaccharide Compositions of Hydrolysates of Beet Hemicelluloses

Monosaccharides	Wt. fraction (%) HMC isolated	
	6% KOH	24% KOH
Uronic acid	13,7	6,3
Galactose	18,3	20,5
Glucose	12,2	18,5
Arabinose	21,2	17,7
Xylose	26,9	21,3
Rhamnose	7,0	12,5

TABLE 2. Monosaccharide Compositions of the HMC Fractions Obtained in Separation on DEAE-Cellulose (molar ratios)

Eluent	Uronic acids	Galactose	Glucose	Arabinose	Xylose
First fraction					
H_2O	10,0	1,8	3,7	0,5	22,7
0,1 M buffer	10 0	0.9	6,2	1,7	7,9
0.3 M buffer	10.0	5,4	4,6	34.0	6.7
0,5 M buffer	7.4	1,5	3,1	6 0	5.3
0,1 N. NaOH	7,4	0,1	3 9	5.1	0.2
0,3 N. NaOH	9,3	1.9	2 9	0,5	6,0
0,5 N. NaOH	1,5	0 8	1,5	1.3	7,2
1,0 N. NaOH	6,5	10,0	5,8	5,8	4,2
Second fraction					
H_2O		2.1	5,8	0,2	4 7
0,1 M buffer	4,3	0,6	4,7	2,0	2.1
0,3 M buffer	3 3	3,5	4,7	10,6	5,2
0 5 M buffer	5,4	0.1	2.9	2.3	1,2
0,1 N. NaOH	9,4	6,4	4,6	2,2	0,2
0,3 N. NaOH	3,9	3,0	3,5	0 4	6,4
0,5 N. NaOH	1,4	3,2	5.2	5 1	11,9
1,0 N. NaOH	6.2	11,3	14,5	9,7	12,5

TABLE 3. Chemical Compositions of the Beet Cellulose Preparations Isolated

Index	Acid method	Alkali-acid method	Kurschner–Hoffer method
RHPs, %	4,1	0 69	1,4
DHPs, %	74,3	57,0	69,4
Residue, %	8,6	12,4	15,0
Protein, %	4,0	1.7	2,3
Cellulose, %	74,3	51,0	53.7
DP	180	175	177

The structure of the beet cellulose was studied on the basis of a comparison of samples isolated by different methods: acid, acid–alkali, and the Kürschner–Hoffer method. The amount of cellulose was established from the results of hydrolysis. The degree of polymerization (DP) was determined viscosimetrically (Table 3). According to the results found, the best method of isolating a cellulose preparation from common beet is the acid method. In the preparation obtained, the amounts and ratios of the amorphous and crystalline fractions were different: 6.6 and 68.6%, respectively.

Simultaneously, a comparative investigation of the structures of the celluloses isolated by the various methods was made by IR spectroscopy. The results obtained confirmed those of chemical analysis and indicated the absence of fundamental structural differences between the polysaccharides.

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LIPIDS OF Potomogeton sp.

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The lipid composition of the freshwater algae growing in the estuary of the R. Volga has scarcely been studied. Investigations of the lipids of freshwater macrophytic algae have been conducted to an extremely limited extent, and the results have been generalized in a number of reviews [1-3]. The composition of the lipids of marine algae has been studied to a greater degree [4-6].

In the present paper we give the results of an analysis of the amounts of various classes of glyco- and phospholipids and the fatty-acid composition of the freshwater alga Potomogeton sp. gathered in the estuary of the R. Volga 150 km to the south of Astrakhan in August, 1990. The extraction of the lipids and the separation and determination of the neutral lipids and the glyco- and phospholipids, and also the analysis of the methyl esters of the fatty acids, were carried out as we have described previously [7, 8]. The composition of the lipids of Potomogeton sp. is given below.

Class of Lipids	PLs, %
Phosphatidylcholine (PC)	30.5 + 2.1
Phosphatidylethanolamine (PE)	22.2 + 1.2
Lysophosphatidylethanolamine	1.9 + 0.2
Phosphatidylserine (PS)	2.8 + 0.3
Phosphatidylglycerol (PG)	18.0 + 0.3
Phosphatidylinositol (PI)	15.0 + 0.4
Phosphatidic acid (PA)	9.6 + 0.6
Phospholipids, % of the total lipids	22.8
Glycolipids, % of the total lipids	43.2
Neutral lipids, % of the total lipids	34.0
Total lipids, mg/g dry weight	39.7

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