INVESTIGATION OF THE POLYSACCHARIDES FROM THE STEMS OF Althaea rugosa

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Continuing an investigation of the carbohydrates of the Malvaceae family [1-4], we have studied the polysaccharides of the stems of Althaea rugosa Alef. collected in the environs of the village of Chkalovka (Sevan region of the Armenian SSR) and in the village of Mirikend (Shamakhinskii region of the Azerbaidzhan SSR) in the period of mass flowering of the plant. Samples of the polysaccharides were obtained separately from the bark and heart of the stems by extraction with water at room temperature and precipitation with ethanol, 1:1 [2] (Table 1). The polysaccharides were demineralized by treating the aqueous solutions with KU-2 cation-exchange resin (H^+ form). The completeness of the demineralization was determined by IR spectroscopy [5]. The uniformity of the samples was established by the ultracentrifugation of 0.5-0.8 solu-

TABLE 1. Characteristics of the Polysaccharides Isolated from the Stems of Althaea rugosa

Characteristics of polysaccharides	Sevan region		Shamakhinskii region	
	bark	heart	bark	heart
Yield, %	3,0	4,5	4,3	8,0
Composition, %				
Ash	1,11	1,09	0,78	0,51
Nitrogen	1,31	1,35	1,60	1,46
Rhamnose	27,4	28,6	24,4	21,6
Glucose	13,7	16,9	11,5	26,4
Galactose	16,1	16,7	31,8	19,8
Arabinose	16,8	11,6	7,2	8,0
Uronic acids	26,2	26,0	25,2	24,4

TABLE 2. Relative Retention Times of the Trimethylsilyl Derivatives of the Carbohydrates of the Neutral and Acid Fractions Isolated from Hydrolyzates of the Polysaccharides of Althaea rugosa

Sevan region		Shamakhinskii region		Marker	Monosaccharides
heart of the stems	back of the stems	heart of the stems	back of the stems		
Neutral fractions					
0,29	0,29	0,31	0,31	0,29	Rhamnose, arabinose
0,41	0,41	0,41	0,41	0,38	Rhamnose
0,88	0,88	0,89	0,89	0,88	α-Galactose
1,00	1,00	1,02	1,02	1,00	α-Glucose
Acid fractions					
0,30	0,30	0,29	0,29	0,29	Rhamnose, arabinose
0,40	0,41	0,41	0,41	0,38	Rhamnose
0,52	0,52	—	—	—	?
0,65	0,61	0,66	0,64	0,65	Glucuronolactone
0,92	0,91	0,92	0,92	0,95	Galacturonic acid
—	1,07	1,10	1,06	1,06	Glucuronic acid
—	—	—	1,35	1,35	Galacturonic acid
1,42	—	1,42	—	1,39	Glucuronic acid

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tions of the demineralized polysaccharides in 0.1 N NaOH in the analytical cell of a MOMU-120 centrifuge at 50,000 rpm. To determine their qualitative carbohydrate compositions, the polysaccharides were subjected to acid hydrolysis, and the hydrolyzates (after neutralization and concentration) were chromatographed on paper [6].

All the samples of polysaccharides consisted of galactose, glucose, arabinose, rhamnose, xylose (traces), and uronic acids. The amounts of the neutral carbohydrates were determined densitometrically (see Table 1) and the uronic acid content by the method of Barker et al. [7].

It was established by paper electrophoresis [6] that the hydrolyzates of all the samples contained galacturonic and glucuronic acids. The results that we obtained were confirmed by the gas–liquid chromatography of the trimethylsilyl (TMS) derivatives of the carbohydrates [8] (Table 2).

EXPERIMENTAL

The gas-chromatographic separation of the TMS derivatives of the monosaccharides was performed on a Pye Chromatograph-104. The stationary liquid phase used was SE-30 (3% by weight) on Chromosorb W (80-100 mesh), the carrier gas was argon (V_{ar} = 30 ml/min). The column was 1.5 m long and 0.4 cm wide, and the temperature was 165°C. The relative retention times were calculated for the TMS derivative of α-glucose.

Before preparing the TMS derivatives of the carbohydrates, we separated the hydrolyzate of each sample of polysaccharide into two fractions: "acid" and "neutral." By adding methanol to the neutralized hydrolyzate we precipitated the Ba salts of the uronic acids, which were separated off by centrifuging. The centrifugate was evaporated to dryness (neutral fraction), the residue was dissolved in water, and the solution was passed through KU-2 resin (H^+ form), after which it was again evaporated to dryness (acid fraction). The fractions so obtained were used to obtain the TMS derivatives of the carbohydrates and for GLC analysis.

The material was collected and identified by N. A. Trukhaleva; the sedimentation analysis was performed by E. A. Sherstnev.

CONCLUSIONS

1. Water-soluble polysaccharides have been isolated from the bark and heart of the stems of Althaea rugosa Alef. collected in the Sevan (Armenian SSR) and Shamakhinskii (Azerbaidzhan SSR) regions with yields of 3.0, 4.5, 4.3, and 8.0%, respectively.

2. It has been established by sedimentation analysis that all the polysaccharides investigated were homogeneous.

3. Each of the polysaccharides contained galacturonic and glucuronic acids, rhamnose, glucose, galactose, and arabinose.

4. The quantitative contents of the monosaccharides in samples of the polysaccharides isolated have been determined.

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