THE NONCARBOHYDRATE PART OF THE POLYSACCHARIDE COMPLEX OF *Solidago virgaurea*

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The ash elements in the inflorescences and polysaccharides of *Solidago virgaurea* L. have been determined qualitatively and quantitatively. Ca^{2+}, K^{+}, Mg^{2+}, and Na^{+} have been detected.

It is known that of the metals it is particularly sodium, potassium, magnesium, and calcium that fulfill important biochemical functions in plants and other living organisms.

We have studied the qualitative and quantitative composition of the mineral fraction of a medicinal plant under investigation, *Solidago virgaurea* L., and of a polysaccharide complex isolated from it, by a procedure that has been published previously [1]. The water-soluble complex isolated from the inflorescences of the plant possesses a high biological activity [2].

The investigations performed showed that the polysaccharide complex being studied contained 40-45% of uronic anhydride and neutral monosaccharides: rhamnose, arabinose, xylose, glucose, and galactose in a quantitative ration of 5:7:1:7:14. The ash content was 20%.

In our study of qualitative reactions of the polysaccharide complex, it was found that its aqueous solution formed colored complexes under the action of the Folin reagent, which indicates the presence of proteins. Continuing an investigation of the chemical composition of the polysaccharide complex, we decided to study its noncarbohydrate part.

EXPERIMENTAL

The material was ashed in a muffle furnace at 600°C for 5 h [3]. The size of the sample depended on the amount of ash elements (0.1-0.2 g). The ash obtained was dissolved in 1-2 ml of a 20% solution of nitric acid and the solution was transferred quantitatively to a 100 ml measuring flask and diluted with distilled water. The insoluble precipitate was filtered off and discarded.

Analysis of the filtrate showed that the alkali and alkaline-earth metals detected in the inflorescences of *Solidago virgaurea* were present in the polysaccharide complex isolated from the same plant.

A quantitative determination of potassium and sodium in the ash of the samples under investigation was carried out by flame photometry on a VPF-VTI photometer [3]. The amounts of these metals were calculated by means of a calibration graph.

The amounts of calcium and magnesium were determined by the trilonometric method, the interfering influence of other metals being eliminated by the addition of sodium diethyldithiocarbamate. Eriochrome Black was used as indicator to determine the sum of the calcium and magnesium, and murexide to determine the calcium [4]. All the results obtained are given in percentages of the mass of the absolutely dry material with fluctuations in the moisture content of 9-11%.

As can be seen from the results obtained (Table 1) the amount of ash elements in the polysaccharides was 2-5 times more than their amount in the plant itself.

The chlorides were determined by Votocek's mercurimetric and argentometric methods using a 30% solution of sodium nitroprusside as indicator [5]. Reproducible results were obtained. The correctness of the results was confirmed by the method of additives. The amounts of chlorides are given in Table 2.

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TABLE 1. Comparative Estimates of the Amount of Ash Components in the Inflorescences and Polysaccharides of *Solidago virgaurea* Family Compositae (n = 5; P = 0.95).

Element	Percentage of the mass of the air-dry raw material (inflorescences) of the absolutely dry polysaccharide					
	inflorescences			polysaccharides		
	$\bar{X}$, %	Sr	$\bar{X} \pm \frac{StP}{\sqrt{n}}$	$\bar{X}$, %	Sr	$\bar{X} \pm \frac{StP}{\sqrt{n}}$
K	3,4	0,003	3,4±0,012	6,8	0,004	6,8±0,033
Na	0,1	0 004	0,1±0,001	0 22	0,003	0,22±0,001
Ca	0,82	0,064	0,82±0,064	1,7	0,050	1,7±0,105
Mg	0,95	0,080	0,95±0,094	5,2	0,050	5,2±0,323

TABLE 2. Determination of Chlorides in the Inflorescence of the European Goldenrod by Various Methods (n = 5; P = 0.95)

Method	Chlorides, %		
	$\bar{X}$, %	Sr	$\bar{X} \pm \frac{StP}{\sqrt{n}}$
Argentometric	0,487	0,050	0,487±0,030
Mercurimetric	0,489	0,055	0,489±0,033

A qualitative analysis was performed beforehand for the absence of anions interfering with the determination of chlorides (S^{2-}, PO_4^{3-}, CO_3^{2-}, $C_2O_4^{2-}$, AsO_3^{3-}, AsO_4^{3-}). Analysis of the ash of the water-soluble polysaccharide showed that they contained no chlorides. The amount of extractive substances in the plant raw material from *Solidago virgaurea* amounted to 13.98%.

The amount of proteins in the polysaccharide complex was determined by Lowry's method [6], which showed the presence of 7.2% of proteins.

The quantitative ratios of the neutral monosaccharides were determined by the GLC of the corresponding acetylated aldononitrile [7].

CONCLUSION

The mineral compositions of the ashes from the inflorescences and from the polysaccharides of *Solidago virgaurea* have been studied. The amounts of alkali and alkaline-earth metals have been determined.

The polysaccharide complex has been shown to contain protein, and the ratio of its neutral monosaccharides has been determined.

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