MINERAL AND PROTEIN COMPOSITION OF THE POLYSACCHARIDE COMPLEX FROM INFLORESCENCES OF *Tanacetum vulgare*

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Tanacetum vulgare L. (common tansy), family *Compositae*, is a widespread medicinal plant that has long been used in folk medicine [1, 2].

The mineral substances and, particularly, the microelements are considered as a component part of the active agents of medicinal plants. Since for biological trials we used an undemineralized polysaccharide preparation, the qualitative and quantitative composition of the mineral fraction of the polysaccharide preparation, the first to be isolated from inflorescences of common tansy [3], was of interest to us.

Analysis of the ash soluble in nitric acid showed that the alkali and alkaline-earth metals detected in the inflorescences of common tansy (K, Na, Ca, Mg) were also present in the polysaccharides of this plant [4], while the polysaccharides contained 2-5 times more than the inflorescences (Table 1).

The study of the cationic composition of the mineral fraction of the inflorescences and of the polysaccharides by the hydrogen sulfide method showed the presence of the following elements in them: Mg^{2+}, Ca^{2+}, Ba^{2+}, K^{+}, Na^{+}, Fe^{3+}, Mn^{2+}, and Al^{3+}.

The results of the investigations showed that the tanning substances of the inflorescences of common tansy must be assigned to the condensed group — catechin and leukoanthocyanins. The amounts of tanning and extractive substances were 3.69 and 14.04%, respectively.

Analysis of the mineral fraction of the plane raw material by the argentometric and mercurimetric methods showed that the chloride content was 0.75%. There were no chlorides in the zone of water-soluble polysaccharides.

The dynamics of the amounts of potassium and sodium in the inflorescences of the common tansy according to the vegetation phases were studies by flame photometry. The maximum amount of the alkali metals was found in the mass flowering phase (%):

	Inflorescences		Polysaccharides	
	K	Na	K	Na
Budding	3.080	0.20	17	0.18
Incipient flowering	3.6	0.22	18	0.38
Mass flowering	4.1	0.24	18.4	0.43

It was established previously [3] that the amount of galacturonic acid in the mass flowering phase was 49.3% of the weight of the dry polysaccharide preparation, which permits this polysaccharide to be assigned to the class of pectin substances.

TABLE 1. Comparative Evaluation of the Amounts of Ash Components in the Inflorescences and Polysaccharides of *Tanacetum vulgare* (mass flowering phase, n = 5; P = 0.95)

Element	Inflorescences, % on the weight of the air-dry raw material			Polysaccharide, % on the absolutely dry raw material		
	$\bar{X}$, %	Sr	$\bar{X} \pm \frac{StP}{\sqrt{n}}$	$\bar{X}$, %	Sr	$\bar{X} \pm \frac{StP}{\sqrt{n}}$
K	4,0	0,003	4,0±0,015	18,5	0,006	18,5±0,138
Na	0,25	0,003	0,25±0,001	0,45	0,005	0,45±0,003
Ca	0,51	0,063	0,51±0,041	2,4	0,057	2,4±0,169
Mg	1,05	0,075	1,05±0,096	5,8	0,050	5,8±0,360

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As can be seen from Table 1, the bulk of the ash in the samples investigated was made up of magnesium and calcium, which are bound in complex form through oxygen atoms with the galacturonic acid present in the material.

It was established by Lowry's method [5] that 6-7% of the weight of the dry polysaccharide preparation consisted of protein impurities. The high content of protein permits the assumption that it was strongly bound to the polysaccharides and was isolated together with them.

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FLAVONOIDS OF *Caragana pygmaea*

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The epigeal part of the shrub *Caragana pygmaea* (L.) D. C. (pigmy peashrub), collected in the flowering period in June, 1982 close to the village of Inya, Gorno-Altai autonomous province, has been studied for the presence of flavonoids.

To obtain the total flavonoids, 0.6 kg of the dried and comminuted raw material was extracted successively with 40, 70, and 96% ethanol. The ethanolic extracts were evaporated in vacuum to an aqueous residue, and this was treated with chloroform to eliminate ballast substances. The flavonoids were extracted from the purified aqueous extract with ethyl acetate, which was evaporated in vacuum. After cooling, the combined flavonoids that had deposited were separated from ethyl acetate residues by centrifugation, dried, and deposited on a column of polyamide sorbent. Then the flavonoids were eluted successively with water and with ethanol in various concentrations.

Five individual substances were isolated: three glycosides (substances (I), (II), and (III)), and two aglycones ((IV) and (V)).

Substance (I) (eluted by 5-10% ethanol) was identified as narcissin (isorhamnetin 3-O-rutinoside), $C_{28}H_{32}O_{16}$, mp 175-178°C (aqueous ethanol), $[\alpha]_D^{20}$ −35.5° (c 0.4; methanol). $\lambda_{max}^{C_2H_5OH}$ 359, 255 nm [1, 2].

Substance (II) (eluted by 30% ethanol) was rutin (quercetin 3-O-rutinoside), $C_{27}H_{30}O_{16}$, mp 185-189°C (aqueous ethanol), $[\alpha]_D^{20}$ − 32.2° (c 0.3; methanol). $\lambda_{max}^{C_2H_5OH}$ 365, 259, nm [1, 2].

Substance (III) (eluted by 40% ethanol) was quercetin 3'-glucoside, $C_{21}H_{21}O_{12}$, mp 177-179°C (aqueous ethanol), $[\alpha]_D^{20}$ − 63.5° (c 0.33; methanol). $\lambda_{max}^{C_2H_5OH}$ 370, 252 nm [1].

Substance (IV) (eluted by 50% ethanol) was 3-methylquercetin, $C_{16}H_{12}O_7$, mp 258-262°C (aqueous ethanol). $\lambda_{max}^{C_2H_5OH}$ 360, 257 nm [1].

Substance (V) (eluted by 70% ethanol) was quercetin, $C_{15}H_{10}O_7$, mp 309-312°C (ethanol), $\lambda_{max}^{C_2H_5OH}$ 373, 255 nm [1, 2].

The structures of all the compounds isolated were confirmed by the results of UV and IR spectroscopy and a study of the products of acid hydrolysis, and also by comparison with authentic samples.

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