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Water-soluble Constituents of Rehmanniae Radix. II.[1] On the Constituents of Roots of *Rehmannia glutinosa* var. *purpurea*.*

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In the previous paper,[1] the presences of fifteen amino acids, phosphoric acid, five monosaccharides and five oligosaccharides in the water extract obtained from the fresh roots of *Rehmannia glutinosa* Libos. forma *hueichingensis* Hsiao were described. We have now described on the water-soluble constituents of roots of *Rehmannia glutinosa* Libos. var. *purpurea* Makino in the present paper. And for the purpose of comparison, data on Chinese dry roots of *Rehmannia glutinosa* Libos. forma *hueichingensis* Hsiao are also presented here.

The extraction and fractionation of the water-soluble constituents by ion-exchange chromatography were carried out as described in the previous report.[1] The yields of fractions from the dry weight of materials are shown in Table I.

Table I. Yields of Fractions

	R. glu. v. *purpurea*		Dry Material of *R. glu.* f. *hueichingensis*
	Fresh Material	Dry Material	
Neutral Frac.	50.1 (%)	67.9 (%)	67.4 (%)
Basic Frac.	2.0	3.1	3.2
Acidic Frac.	2.7	3.2	6.2

The neutral fractions were analyzed by cellulose thin-layer chromatography and gas-liquid chromatography of trimethylsilyl derivatives. D-Glucose, D-galactose, D-fructose, D-mannitol, sucrose, raffinose, manninotriose, stachyose, and verbascose were found in each sample. For the quantitative analyses of them, the fraction was separated into several parts by the use of paper chromatography. Monosaccharides were determined by gas-liquid chromatography of trimethylsilyl derivatives, and oligosaccharides were estimated colorimetrically. The contents of them in the neutral fractions are shown in Table II.

The basic fractions were examined by two dimensional cellulose thin-layer chromatography and determined by the use of an amino acid analyzer. For the analysis of D-glucosamine, gas-liquid chromatography and Elson-Morgan reaction were also utilized. In consequence of cellulose thin-layer chromatography of the acidic fractions, phosphoric acid was detected and determined colorimetrically.[2] The names and contents of the

* 本報告は *Chem. Pharm. Bull.* (Tokyo), **19**, 2411 (1971) に発表.

1) Part I: M. Tomoda, S. Kato, and M. Ōnuma, *Chem. Pharm. Bull.* (Tokyo), **19**, 1455 (1971).

2) P. S. Chen, Jr., T. Y. Toribara, and H. Warner, *Anal. Chem.*, **28**, 1756 (1956).

TABLE II. Contents of Carbohydrates in Neutral Fractions

	R. glu. v. *purpurea*		Dry Material of *R. glu.* f. *hueichingensis*
	Fresh Material	Dry Material	
Fructose	1.9 (%)	3.1 (%)	5.6 (%)
Glucose	1.7	2.2	9.1
Galactose	3.1	5.3	1.6
Mannitol	7.4	3.0	1.0
Sucrose	2.8	8.1	7.6
Raffinose	3.6	8.7	7.7
Manninotriose	1.0	4.2	5.6
Stachyose	62.7	47.8	32.1
Verbascose	4.6	4.3	2.7

TABLE III. Contents of Components in Basic and Acidic Fractions

	R. glu. v. *purpurea*		Dry Material of *R. glu.* f. *hueichingensis*
	Fresh Material	Dry Material	
Lysine	0.2 (%)	0.4 (%)	—
Histidine	0.1	0.2	—
Arginine	4.2	6.8	4.2 (%)
Aspartic acid	0.8	1.5	0.1
Glutamic acid	1.4	1.6	0.2
Threonine	1.6	0.5	0.1
Serine	0.2	0.1	0.1
Glycine	0.1	0.2	0.2
Alanine	0.4	0.6	0.3
Valine	0.1	0.4	0.2
Methionine	—	—	0.1
Isoleucine	0.4	0.2	0.2
Leucine	0.2	0.2	0.2
Tyrosine	0.1	0.3	0.3
Phenylalanine	0.1	0.2	0.2
Proline	—	0.4	0.3
γ–Amino butyric acid	3.0	3.1	—
Glucosamine	0.8	2.6	2.5
Phosphoric acid	1.1	2.1	2.0

components of each fraction are shown in Table III.

Until now, no report on oligosaccharides and amino acids in the roots of *Rehmannia glutinosa* var. *purpurea* has been appeared, but from the result of the determination of water-soluble constituents, we concluded that stachyose is the conspicuous chief component in the all materials used in the present study. Stachyose content in the extract obtained from fresh roots is higher than that in the extract from dry roots, and on the contrary,

the contents of hexoses, sucrose and trisaccharides were more abundantly in the extract from dry material. Because these monosaccharides and oligosaccharides are components of stachyose, it is conceivable that considerable amounts of these carbohydrates are secondary degradation products derived from stachyose.

Although the yields of basic fractions were considerably lower than those of neutral fractions, L-arginine is the most abundant amino acid in the all materials. Among other amino acids, γ-amino butyric acid attracts attention by reason of the fact that it is relatively rich in the roots of *Rehmannia glutinosa* var. *purpurea* in contrast with the material from the other plant.