Chemistry of Natural Compounds, Vol. 37, No. 6, 2001

B R I E F C O M M U N I C A T I O N S

POLYSACCHARIDES OF RICE STRAW

A. N. Brylev,[1] D. K. Adylov,[1] G. G. Tukhtaeva,[1] N. A. Kamal′dinova,[1] L. D. Abidova,[1] and D. A. Rakhimov[2]

UDC 547.917.676.1.022.1

Polysaccharides of annual plants have been studied less than those of woody ones because they are not used much in industry. However, plant material such as rice straw have recently been acquiring more industrial value owing to their chemical, in particular, carbohydrate, content.

Ripe rice straw obtained after collecting the grain, cleaning, sorting, and grinding was treated with a solvent mixture (alcohol—chloroform, 1:2 by volume) to remove low-molecular-weight compounds. Polysaccharides were exhaustively extracted from one lot of material successively by water at room temperature, a mixture of 1.0% solutions of oxalic acid and ammonium oxalate (1:1) at 70°C, and alkali (10 and 18% aqueous solutions). The aqueous and acidic extracts were condensed. Polysaccharides (PS) were precipitated by alcohol to produce the corresponding water-soluble polysaccharides (WSPS) and pectinic substances (PS). The alkaline extracts were neutralized by CH_3COOH. This precipitated hemicelluloses (HMC-A and HMC-B). The filtrate was treated with three volumes of alcohol to isolate hemicelluloses A_1 and B_1. The monosaccharide content of the PS fractions was determined after acid hydrolysis (2 N H_2SO_4, 10 h, 100°C) by paper chromatography (PC) and GC using the literature conditions [1]. The yield of the fractions and their monosaccharide content are listed in Table 1.

The rice-straw pulp left after isolating the PS fractions underwent acid hydrolysis. The hydrolysate was analyzed by PC. Mainly glucose was observed.

Hemicelluloses, the total content of which was 25.2%, dominate in the straw.

The WSPS form an amorphous powder that is very soluble in water. It has no reducing power. The reaction with starch is negative. Glucose and galactose dominate in the hydrolysate. Therefore, the WSPS contain PS of the glucogalactan type.

The PS are obtained as white amorphous powders that are soluble in water and form viscous solutions. The predominant monosaccharide in PS is glucose. However, this is not due to the starch content. The PS hydrolysate contains a significant amount of galacturonic acid.

TABLE 1. Content and Monosaccharide Composition of Rice-Straw Polysaccharides

PS type	Yield, % of air-dried mass	Monosaccharide ratio					
		Rha	Ara	Xyl	Man	Glc	Gal
WSPS	0.73	2.3	-	1.0	1.6	4.8	7.4
PS	2.1	1.0	1.8	1.9	Tr.	6.0	1.0
HMC-A	12.7	1.0	3.6	46.1	-	-	-
HMC-B	6.6	1.0	2.8	10.2	-	1.0	Tr.
HMC-A_1	4.0	1.0	1.5	45.0	-	-	-
HMC-B_1	1.9	Tr.	1.2	4.7	-	1.2	1.0

1) Association "Uzmashprom," Tashkent Scientific-Research Institute of Chemical Technology, 702174, Tashkent District; 2) S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Tashkent, fax (99871) 120 64 75. Translated from Khimiya Prirodnykh Soedinenii, No. 6, pp. 488-489, November-December, 2001. Original article submitted November 19, 2001.

0009-3130/01/3706-0569$25.00

The hemicelluloses are water-soluble powders. The aqueous solutions do not react with iodine in the presence of starch. Xylose and arabinose dominate the HMCs. Rice-straw HMCs typically lack glucomannans and galactoglucomannans. Rice straw can be recommended for paper production because of the large amount of HMCs present. This makes it easier to mash the cellulose mass and improves the paper properties [2]. Cellulose is obtained in 50% yield by boiling rice straw in NaOH solution (2%). This is used for paper production [3].

Thus, the investigations of rice-straw carbohydrates isolated the principal carbohydrate fractions and established their monosaccharide composition.

REFERENCES

1. M. R. Mirzaeva, R. K. Rakhmanberdyeva, E. L. Kristallovich, D. A. Rakhimov, and N. I. Shtonda, *Khim. Prir. Soedin.*, 727 (1998).
2. V. N. Sharkov and N. I. Kuibina, *Chemistry of Hemicellulose* [in Russian], Lesnaya Promyshlennost′, Moscow (1972).
3. L. I. Kurgul′tseva, A. N. Brylev, D. K. Rakhimova, V. I. Tolmasov, A. K. Kasymov, L. L. Gubareva, L. M. Bagaeva, and T. V. Luk′yanova, Uzb. Pat. No. 3827 (1995); *Rasmii Akhborotnoma*, No. 3, 84 (1996).