TECHNOLOGY OF THE PRODUCTION OF PECTIN SUBSTANCES FROM THE FRUIT OF *Sorbus aucuparia*

S. A. Deren'ko and N. I. Suprunov

UDC 547.56

The optimum conditions for the isolation of pectin substances from a pulp of the European mountain ash freed from lipophilic substances have been studied, and the characteristics of the substances are given.

Interest is being shown in pectin substances as auxiliary components, suspension stabilizers, and emulsifying agents from the point of view of their use in pharmacy [1, 2]; they are also used in the food industry [3].

In the production of beverages, jellies, and jams the juice of the fruit of the mountain ash is used as an additive [4], and the fruit pulp is discarded as an industrial waste.

With the aid of utilizing the pectin substances from the pulp we set ourselves the task of selecting the optimum conditions for their isolation and of giving their characteristics. The initial raw material was the whole fruit pulp freed from lipophilic substances. The amount of lipophilic substances in the pulp was 12% on the absolutely dry weight. Below we give results showing the dependence of the yield of pectin substances on the concentration of hydrochloric acid solutions (in percentages on the absolutely dry weight):

HCl	Pectin substances, %
0.1N	8.56
0.2N	9.80
0.3N	10.59
0.4N	8.77
0.5N	6.73
1.0N	4.72
1.5N	3.79
2.0N	2.00

As analysis showed, the optimum concentration of hydrochloric acid is a 0.3 N solution. This concentration permits the largest amount of pectin substances (10.59%) to be obtained. A rise in the concentration of the hydrochloric acid led to a fall in the yield of pectin substances.

The dependence of the yield of pectin substances on the concentration of solutions of ammonium oxalate is as follows (in percentages on the absolutely dry weight):

Ammonium oxalate, %	Pectin substances
0.1	7.61
0.5	9.35
1.0	8.83
1.5	8.61

The largest amount of pectin substances is extracted by the use of a 0.5% solution of ammonium oxalate.

Thus, in the isolation of the pectin substances from the pulp of the fruit of the mountain ash freed from lipophilic substances it is desirable to use a 0.3 N solution of hydrochloric acid or a 0.5% solution of ammonium oxalate. However, the 0.3 N solution of hydro-

Academician I. P. Pavlov Ryazan' Medical Institute. Translated from Khimiya Prirodnykh Soedinenii, No. 6, pp. 777-780, November-December, 1979. Original article submitted August 20, 1979.

 0009-3130/79/1506-0686$07.50

chloric acid extracts 1.24% more pectin substances than the 0.5% solution of ammonium oxalate.

In order to reduce the consumption of ethanol we performed an experiment to determine the optimum proportion of ethanol to be added to the extracts obtained with a 0.3 N solution of hydrochloric acid and a 0.5% solution of ammonium oxalate. To the extracts of pectin substances obtained we added ethanol in ratios of 1:1, 1:2, 1:3, 1:4, and 1:5. Analysis showed that at a ratio of extract to ethanol of 1:2 it was already possible to precipitate a fairly large amount of pectin substances. At a ratio of 1:4 the yield of pectin substances increased by only 0.96%.

Consequently, to precipitate the pectin substances from one part of extract obtained with a 0.3 N solution of hydrochloric acid or a 0.5% solution of ammonium oxalate it is sufficient to add two parts of ethanol.

The pectin substances obtained formed a light-brown odorless powder slimy to the taste. To characterize them we determined their ash content, monosaccharide composition, viscosity, and jellying capacity.

The ash content of the pectin substances isolated with the aid of the 0.5% solution of ammonium oxalate was 7.06%, and by the use of the 0.3 N solution of hydrochloric acid it was 2.80%. Galacturonic acid, galactose, glucose, arabinose, xylose, and rhamnose were found in the products of the complete acid hydrolysis of the pectin substances.

The jelly-forming capacity of a pectin depends on the viscosity of its solution. The viscosities of solutions of the pectin substances were studied at various concentrations. The results in the form of the relative viscosity η_{rel}, the specific viscosity η_{sp}, and the reduced viscosity η_{red} as functions of the concentrations of the solution were as follows (the time of outflow of the solvent t' in all the calculations was 83 sec):

Time of outflow of a solution of the pectin, t", sec	Concentration C of the pectin, %	$t_{rel} = \frac{t''}{t'}$	$\eta_{sp} = \frac{t''-t'}{t'}$	$\eta_{red} = \frac{\eta_{sp}}{C_{sp}}$
125,3	0,10	1,51	0,51	5,10
137,3	0,125	1,65	0,65	5,20
156,9	0,20	1,89	0,89	4,45
185,1	0,25	2,23	1,23	4,92
216,2	0,30	2,60	1,60	5,33
253,3	0,40	3,05	2,05	5,13
311,6	0,50	3,75	2,75	5,50
516,5	1,00	6,22	5,22	5,22

Thus, solutions of the pectin possessed a high viscosity. The relative and specific viscosities rose rapidly. With a comparatively small change in the concentration of the pectin substances there is an extremely rapid increase in the viscosity of the solutions tested. Thus, the relative viscosity of a 1% solution of pectin substances was four times higher than the viscosity of a 0.1% solution.

A jelly containing 1% of the pectin substances obtained consisted of a dense mass, which showed their good jellying capacity.

The dependence of the density of the jelly on the viscosity of the pectin solutions was determined from the table of Myers and Baker [5]. It was found that to obtain a standard jelly (60 g of sugar in 100 g of jelly at pH 3.0-3.6) 0.3 g of mountain ash pectin was sufficient.

Thus, the high amount and good jellying properties of the pectin substances of the fruit of the mountain ash make them a promising material for use in medicine, pharmacy, and the food industry.

EXPERIMENTAL

The amount of pectin substances and their jellying capacity were studied by known methods [6]. The pectin substances were isolated with solutions of hydrochloric acid and of ammonium oxalate in the boiling water bath for 1 h. The pectin substances were precipitated with 96% ethanol. The ash content was determined by the method of the State Pharmacopoeia (Xth ed.) [7]. The monosaccharide composition of the pectin substances was determined by

paper chromatography (on FN-15 paper) [8]. Viscosities were measured in an Ostwald viscometer with a capillary having a diameter of 0.54 mm at 25°C.

SUMMARY

The optimum conditions for the isolation of the pectin substances from the pulp of mountain ash fruit freed from lipophilic substances have been found. It has been established that the isolation of the pectin substances is best performed with a 0.3 N solution of hydrochloric acid or a 0.5% solution of oxalic acid, and precipitation at a ratio of extract obtained to 96% ethanol of 1:2.

The characteristics of the pectin substances are given. Their ash content, monosaccharide composition, viscosity, and jellying capacity have been studied.

LITERATURE CITED

1. A. I. Tentsova, Aptechn. Delo, No. 4, 15 (1962).
2. B. N. Stepanenko, Yu. A. Blagovidova, and O. I. Belova, Aptechn. Delo, No. 2, 3 (1963).
3. F. V. Tserevitinov, A. A. Kolesnik, and V. V. Aristovskii, Pishch. Promst' SSSR, No. 5, 66 (1946).
4. F. V. Tserevitinov, The Chemistry and Marketing of Fresh Fruit and Vegetables [in Russian], Moscow, Vol. 2 (1949), p. 58.
5. P. B. Myers and E. L. Baker, Del. Agric. Exp. Stn. Bull., No. 149, 1 (1927).
6. V. V. Arasimovich, S. V. Boltaga, and N. P. Ponomareva, Methods for Analyzing Pectin Substances, Hemicelluloses, and Pectolytic Enzymes [in Russian], Kishinev (1970).
7. State Pharmacopoeia of the USSR [in Russian], Tenth ed., Moscow (1968).
8. N. I. Suprunov, Questions of the Development of New Drugs. Scientific Proceedings of the Academician I. P. Pavlov Ryazan' Medical Institute [in Russian], Ryazan', Vol. 50 (1975), p. 12.

MOLECULAR COMPOSITION OF THE N-ACYLPHOSPHATIDYLETHANOLAMINE OF THE COTTON PLANT OF VARIETY S-6029

A. Sh. Isamukhamedov and S. T. Akramov

UDC 545.953:665.37

An N-acylphosphatidylethanolamine has been isolated from the total phospholipids of the cotton plant of variety S-6029. The composition and the position distribution of the fatty-acid radicals has been studied with the aid of enzymatic hydrolysis with phospholipase A_1 (from the fungus Rhisophus microsporus UzLT-1) and by alkaline and acid hydrolyses. From the results obtained, the possible molecular composition of the N-acylphosphatidylethanolamine has been calculated by Coleman's method. The total number of all the molecular species amounted to 720.

We have reported previously that unidentified phospholipids have been found in the total phospholipids of the cotton plant of variety S-6029 [1], and one of them was obtained in the homogeneous form. It had an N:P:RCOO ratio of 1:1:3 and gave a negative ninhydrin reaction. Its structure as an N-acylphosphatidylethanolamine (N-acyl-PE) was confirmed by its chromatographic behavior, by IR spectroscopy, and from the products of hydrolysis [2-6].

In view of its unusual structure, an N-acyl-PE does not form the enzyme-substrate complex that is necessary for enzymatic hydrolysis and is not a specific substrate for the phospholipase A_2 from the venom of Vipera lebatina obtusa. Consequently, structural studies of native N-acyl-PEs lag behind those of other phospholipids, particularly in the position distribution of the acyl radicals in the molecule.

Institute of the Chemistry of Plant Substances, Academy of Sciences of the Uzbek SSR, Tashkent.

Translated from Khimiya Prirodnykh Soedinenii, No. 6, pp. 780-783, November-December, 1979. Original article submitted June 15, 1979.

0009-3130/79/1506-0688$07.50