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

CARBOHYDRATES FROM *Cynara scolymus*

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Cynara scolymus L. (Asteraceae) is a valuable vegetable and medicinal plant that possesses choleritic, antioxidant, and hypolipidemic activity [1]. Although polyphenols in artichoke have been well studied, the carbohydrate content is unknown [2].

Leaves (41.0 g) of *C. scolymus* were extracted in a Soxhlet apparatus with $CHCl_3$ (250 mL) for 14 h. The remaining plant material was extracted with boiling ethanol (82°C) to isolate the sugars soluble in alcohol (SSA). The plant material was dried. The extracts were combined, evaporated, and chromatographed on Filtrak FN7 and -12 paper. According to paper chromatography (PC), the SSA include fructose, saccharose, and traces of glucose. Then the polysaccharides were fractionally separated.

Isolation of Water-soluble Polysaccharides (WSPS). The remaining plant material was extracted twice with water (500 and 250 mL) with constant stirring at room temperature. The extracts were evaporated to 30 mL, precipitated with ethanol (1:3), washed with alcohol, and dried with acetone. Yield of WSPS-C, 2.1 g (5.12% of air-dried mass).

Extraction of WSPS with Hot Water (WSPS-H). The remaining plant material was extracted on a water bath at 80°C (2 × 200 mL). The extract was evaporated to 60 mL and precipitated with alcohol (180 mL). The solid was separated and dried as above. Yield of WSPS-H, 0.32 g (1.78%).

Extraction of Pectinic Substances (PS). The plant material remaining after WSPS extraction was extracted twice with a mixture of oxalic acid and ammonium oxalate solutions (0.5%, 250 and 200 mL) on a water bath at 70°C for 3 h, evaporated to 20 mL, and precipitated with alcohol (120 mL). The solid was centrifuged and dried. Yield 1.0 g (2.4%).

Isolation of Hemicelluose (HC). The plant material remaining after isolation of PS was twice stirred with NaOH solution (10%, 200 and 150 mL). The extracts were combined, neutralized with acetic acid, dialyzed, evaporated to 30-40 mL, and precipitated with alcohol (1:3). The solid was dried. Yield 1.08 g (2.63%).

Hydrolysis of Carbohydrates. WSPS-C and WSPS-H were hydrolyzed by H_2SO_4 (1 N) for 10 h; PS and HC, by H_2SO_4 (2 N) for 24 h in ampuls on a boiling water bath [3].

The hydrolysates were neutralized with $BaCO_3$, deionized by cation-exchanger KU-2 (H^+), evaporated to 1 mL, and studied by PC using *n*-butanol:pyridine:water (6:4:3) with development by anilinium biphthalate (for hexoses), alcoholic urea (5%, for ketoses), and GC (as aldononitrile acetates) [4].

Samples were analyzed on a Chrom-5 chromatograph with a flame-ionization detector, glass column (150 × 0.3 cm), Silicone XE-60 (5%) on Chromaton NAW-0.200-0.250 mesh, thermostat 210°C, detector 280°C, and N_2 carrier gas at 60 mL/min.

Table 1 gives the results from acid hydrolysis of the polysaccharide fractions.

WSPS-C, green powder, soluble in water to form a nonviscous solution with relative viscosity 1.06 (*c* 1%, water).

WSPS-H, dark green powder, dissolves in water to give a solution of viscosity 1.21 (*c* 1%, water).

PS, friable cream-colored powder, partially soluble in water, titration found that PS contain A_f 9.7%, A_e 8.1%, λ 45.5% [5]. Therefore, artichoke PS were low-esterified pectins.

HC, dark brown powder, insoluble in water.

Based on the results, carbohydrates of *C. scolymus* fractions WSPS and HC are most promising for pharmacological investigations.

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TABLE 1. Content and Monosaccharide Composition of Polysaccharides from *Cynara scolymus* Seeds

Polysaccharides	PS yield, %	Ratio of monosaccharide units						
		Rham	Xyl	Ara	Man	Glc	Gal	UAc
SSA	21.34	-	-	-	-	Tr.	-	-
WSPS-C	5.1	-	1.0	1.4	Tr.	24.6	7.3	+
WSPS-H	0.78	1.62	3.2	2.2	1.0	Tr.	2.4	+
PS	2.4	4.3	1.0	2.5	-	-	1.4	+
HC	2.63	Tr.	8.76	4.6	1.4	1.0	4.8	+

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