

EVALUATION OF RAPESEED MEAL PECTIN

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ABSTRACT

Pure pectic substances were obtained in 22.52% from rapeseed meal (*Brassica napus*) variety (Semu, Gi, AD1). The obtained results showed that this pectin can be used safely for edible uses and very suitable to form gel of high quality for food industrial purposes. The average of its molecular weight was 64.26×10^3 .

I.R. spectrum and specific optical rotation showed that the major glycosidic linkages of this pectin is of the α -type in C_1 pyranose conformation.

INTRODUCTION

During the last three years many scientists have introduced rapeseed as a source for edible oil production. The pectic substances of rapeseed meal was examined during this work in an attempt to get more information about the properties of this polysaccharide and its possible use in the field of food industry.

Aspinall and Jiang (1974) extracted pectic substances of rapeseed hull with 83% degree of esterification. Lockwood (1976) mentioned that the presence of acetyl groups in high amounts i.e. 3.6% in sugar beet pectin, prevented Jelly formation.

Neukom (1967) and Devine (1974) reported that molecular weights of commercial apple, and sugar beet pectins were 67000 and 62000, respectively.

MATERIALS AND METHODS

I- Isolation and purification of polysaccharide:

The pectic substances were isolated from rapeseed meal (*Brassica napus*) variety (Semu, Gi, AD1) which were obtained from Fac. of Agric., Cairo Univ. The extraction of pectin from rapeseed meal was carried out according to the method reported by Aspinall and Jiang (1974). The extracted pectin was purified by the method described by Shalom et al. (1984).

Two types of citrus pectin (citrus pectin from grape fruit and slow set citrus pectin) were brought from H.P. Bulmer Ltd. Comp., England.

II- Chemical analysis of pectin:

Moisture, ash content and detection of glucocinolate compound were carried out according to A.O.A.C. (1980).

Determination of cations: The different cations were determined using a Pye unicam atomic absorption spectrophotometer.

Acetyl content was determined as the method described by Pippen et al. (1950).

Determination of reducing power (Ferricyanide number) was carried out as described by Schoch (1961).

Methoxyl content, degree of esterification and anhydrogalactouronic acid content were measured by titration method according to Joslyn and Deuel (1963), anhydrogalactouronic acid was once more determined using carbazole method, Furutani and Osajima (1965).

Pentoses content was determined by the orcinol reaction of Schneider (1957). Total carbohydrates were measured by anthrone method (Helbert and Brown, 1957).

III- Physical analysis of pectin:

Optical rotation was determined using Bellingham and Stanley polarimeter. The results were calculated as reported by Willard et al. (1974).

Estimation of the relative viscosities of rapeseed pectin and citrus pectin were carried out according to the method mentioned by Sarhan (1975).

IV- Determination of molecular weight:

The average of molecular weight was determined as described by Sarhan (1975).

V- Determination of jelling power:

The SAG test was carried out to determine the technological value of pectin. This test was achieved on the basis of the SAG test standardized by the I.F.T. (International Food Technology) Committee on pectin Standardization (1959).

Rapeseed meal pectin was examined spectrophotometrically using Perkin Elmer, 297, I.R. Spectrophotometer.

RESULTS AND DISCUSSION

The purified pectin of rapeseed meal amounted to 22.52% (on the dry basis weight), which could be considered as a valuable source for pectin production.

1. Chemical and physical properties of rapeseed meal pectin:

The obtained results are shown in Table (1). The results indicated that the content of moisture in rapeseed pectin is less than the amounts reported by Kertesz (1951) and Joseph (1945), ranging from 7.2% to 14.9, in different pectins produced in the United States.

The ash content (4.579 mg/100 g) of the examined pectin was very satisfactory since it was relatively very low in comparison with the maximum permitted in some foreign countries, i.e. ash content for edible pectin is not supposed to exceed 12% (Kertesz, 1951). Calcium is the major element in rape meal pectin, Table (1) while copper and zinc are present in very minute quantities. In general, the content of elements (especially,

poisonous heavy metals) was lower than that found in some American commercial pectins according to Joseph (1945).

Table (1): Chemical characteristic and physical properties of rapeseed meal pectin.

Constituents	"calculated on dry weight basis"
Moisture	3.429 %
Ash (mg/100g)	4.5386
Analysis of the ash (as mg/100 g on dry weight basis)	
Calcium	509
Iron (Fe^{++} , Fe^{+++})	28
Potassium	310
Magnesium	72
Copper	3.9
Zinc	5.2
Sodium	256
Total carbohydrates "Anthrone method" :	90.80 %
-Anhydrogalacturonic acid "carbazole method"	72.08 %
-Anhydrogalacturonic acid " titrimetric method"	71.104%
-Pentoses content	8.05 %
-Hexo - neutral sugars "calculated by difference"	10.67 %
Methoxyl content	7.105 %
Acetyl content	0.43 %
Degree of esterification	78.70
Ferricyanide number	4.49
pH	3.45
Refractive viscosity (η_r) in water (0.1 g pectin/100 ml)	1.5224
Optical rotation $[\alpha]_D^{25}$	+213°

One of the important values in estimation of pectin quality is determining its anhydrogalactouronic acid (A.G.A.) content. Consequently this value was measured during this work with two different methods, first is titrimetric method and second is colorimetric using carbazole, Table (1). The two values obtained were 71.104 and 72.080 for titrimetric and colorimetric respectively. The slight difference arised in both methods might be attributed to the formation of some complex binding between the carbonyl and polyvalent metal ions which hinder the saponification reaction after the addition of alkali in titerimetric method leading to a little decrease in A.G.A. content. The obtained results are in good agreement with that reported by Kawabata (1977) for different materials of pectic substances i.e. 71.3%, 74.8% and 68.3% for apple, shaddock and summer orange, respectively.

Total neutral sugars and pentoses content are two important criteria in gel network. The results cited in Table (1) showed that proportion of these sugars are within the values reported by Kawabata (1977).

The obtained figure for esterification degree, 78.71 was so close to the value reported by Aspinall and Jiang (1974). On the other hand the obtained value for methoxyl content 7.108% classified rapeseed meal pectin as a high methoxyl pectin, Jackman (1983).

Rapeseed meal pectin contained 0.43% acetyl content. This little value indicates that this pectin has high technological quality from the view point of acetyl content, since it contains only a minute quantity of acetyl groups which would be unlikely affect the ability to form Jel (Lockwood, 1976).

Ferricyanide number, pH, relative viscosity and specific optical rotation were reported in Table (1). The obtained results are in good agreement with those mentioned by Sarhan (1975) and El-Arnauty (1982) for onion and different citrus peel pectins.

Finally examination of glucocinolate as toxic material indicated that rapeseed meal pectin is completely free, consequently this type of pectin could be used safely for edible purposes.

2. Viscosity and molecular weight:

The results of viscosity measurements is shown in Table (2) and Fig. (1) of rapeseed meal and citrus pectins. The latter pectin was undertaken into consideration which might be helpful in comparison study. The molecular weights were calculated according to relation between the molecular weight (M.W.) and intrinsic viscosities (η_i); applied by many investigators (Smit and Bryant, 1967; Sarhan, 1975).

Table (2): Viscosity measurements of rapeseed meal pectin (R.M.P.) and citrus pectin (grape fruit) (C.P.) at pH 6.5, temperature 25°C in phosphate buffer.

Concentration g/dl	t_0 solvent flow time in seconds	t flow time in seconds		η_r relative vis- cosity		η_r/c		η_{sp} specific vis- cosity		η_{sp}/c intrinsic viscosity	
		R.M.P.	C.P.	R.M.P.	C.P.	R.M.P.	C.P.	R.M.P.	C.P.	R.M.P.	C.P.
0.200	53	88.0	96.0	1.660	1.811	8.302	9.057	0.6606	0.8113	3.302	4.057
0.175	53	82.5	89.0	1.557	1.679	8.895	9.596	0.5566	0.6792	3.181	3.381
0.150	53	78.0	83.2	1.472	1.5698	9.811	10.465	0.4717	0.5698	3.145	3.799
0.100	53	69.5	73.0	1.311	1.3774	13.773	13.773	0.3113	0.3774	3.113	3.774
0.075	53	65.5	-	1.236	-	16.478	-	0.2358	-	3.145	-
0.050	53	61.0	62.5	1.151	1.179	23.019	23.585	0.1519	0.1792	3.019	3.585

The average molecular weight of rapeseed meal pectin was 64.26×10^3 . Such result is less than that obtained for citrus pectin, 75.53×10^3 and in good agreement with that obtained by Neukom (1967) and Devine (1974).

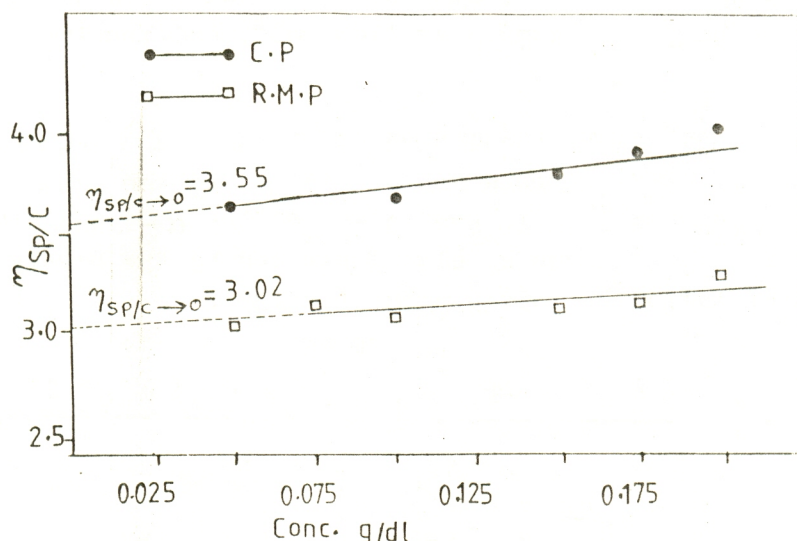


Fig.(1): Intrinsic viscosity of rapeseed meal (R.M.P.) and citrus (C.P.) pectins.

3. Gelling properties of rapeseed meal pectin:

The quality of pectin in the present work was determined on the basis of the SAG test standardized by the I.F.T. committee on pectin standardization, (1959), the results are shown in Table (3).

Table (3): Gelly grade of rapeseed meal and citrus pectins.

Type	Gelly grade
Rapeseed meal pectin	306.
Citrus pectin (Slow set pectin)	332
Citrus pectin (grape fruit)	344.5

The obtained results in Table (3) indicated that the values of gelly grade of rapeseed meal pectin and both types of citrus pectin varied slightly and are comparatively higher than those reported by Smith and Bryant (1967), specially for citrus pectin, (grape fruit), 344.5.

On the basis of the values of SAG grade reviewed by Jackman (1983), the pectin under investigation is considered suitable to form firm gel with high gel strength.

4. Infra-red absorption spectrum:

Figure (2) shows the infra-red absorption spectra of rapeseed meal pectin and citrus pectin (slow set pectin). A board absorption band was noticed near 3400 Cm⁻¹ which mostly is due to OH stretching vibrations. The presence of a distinct band at Ca 2960 Cm⁻¹ in the spectra was probably due to C-H stretching in methyl groups (Manabe, 1971) of deoxy sugars, e.g. rhamnose. Absorption between 1700 Cm⁻¹ and 1600 Cm⁻¹ was mostly due to C = O stretching vibration from carbonyl groups. Absorption near 1440 Cm⁻¹ could be attributed to C-H deformation from ester and methoxyl groups

(Reintjes et al., 1962). Primary alcohol is shown to occur near 1050 cm^{-1} , while that of secondary was found near 1100 cm^{-1} , and tertiary alcohol is near 1150 cm^{-1} .

The characteristic vibrational band at $810\text{--}840\text{ cm}^{-1}$ (equatorial C,H) (Whistler and House, 1953) gives a great evidence to the assumption that major glycosidic linkages in this pectin are of the α -type in C_1 pyranose conformations. Such result can be also supported by the highly positive specific optical rotation of this pectin, ($+213^\circ$).

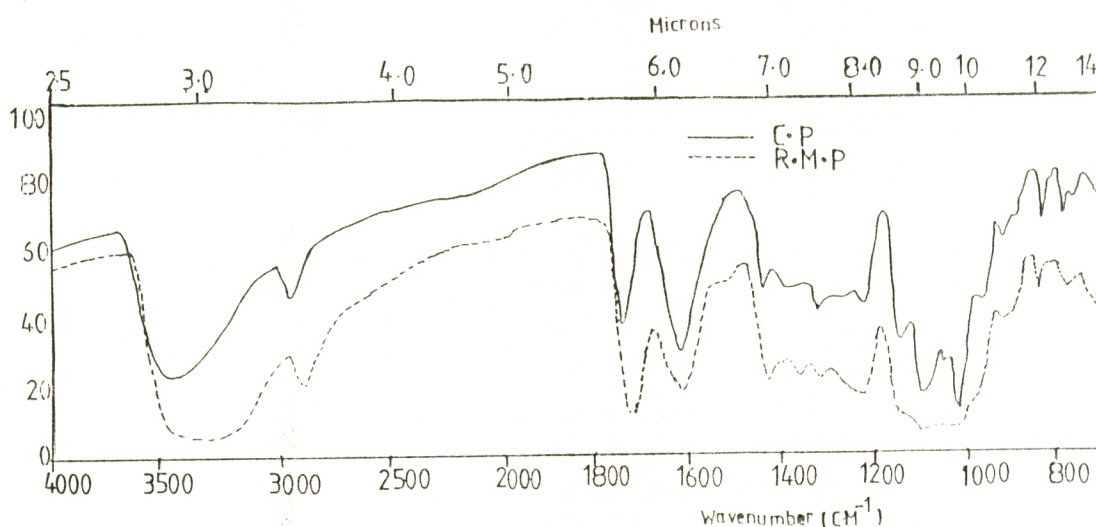


Fig.(2): I.R. spectra of rapeseed pectin (R.M.P.) and citrus pectin (C.P.).

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تقييم بكتين كسب بذور الشلجم (اللفت) .

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تم استخلاص المواد البكتينية من كسب بذور الشلجم (اللفت) في صورة نقيصة بنسبة ٢٢.٢٢% .

ودرسست الخواص الطبيعية والكيميائية والتكنولوجية للبكتين المستخلص وقدر متوسط الوزن الجزيئي ووجد انه يساوى 10×10^4 . وأوضحست النتائج انه يمكن استخدام هذا النوع من البكتين في الاستعمال الادنى .

ودرسست أيضا خواص البكتين من حيث قدرته على تكوين الجيل ووجد ان له القدرة على تكوين جل قوى وثابت وذلك بمقارنته ببكتين الموالح والمتحصل عليه من شركة بولمر (انجلترا) مما يشجع استخدامه في مجال صناعة الاغذية .

والتحليل الطيفي باستخدام جهاز الاشعة تحت الحمراء للبكتين النقى المستخلص والبكتين المستورد أظهرت النتائج وجود تشابه كبير وان الرابطة الجليكوسيدية بين وحدات السكر النباتية من النوع ألفا - بيرانونز .