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CHARACTERIZATION OF PECTIN EXTRACTED FROM DIFFERENT FRUIT WASTES

With the increase in production of processed fruit products, the amount of fruit wastes generated is increasing enormously. Large amount of these wastes poses the problem of disposal without causing environmental pollution. These wastes can be effectively disposed by manufacturing useful byproducts from them.

A valuable byproduct that can be obtained from fruit wastes is pectin. Pectin designates those water sluble pectinic acid (colloidal polygalacturonic acids) of varying methyl ester content and degree of neutralization, which are capable of forming gels with sugar, and acids, under suitable conditions (GITCO, 1999). It is used in pharmaceutical preparation as filler, as an agglutinator in blood therapy and also to glaze candied fruits. Besides, it can be used to increase the foaming power of gases in water.

The suitability of pectins for different purposes is determined by their characters viz., anhydro-uronic acid content, methoxyl content, degree of esterification and acetyl value. Hence, it is an unavoidable aspect that every pectin should be described properly for its biochemical characters.

To analyze the biochemical characters, pectin was extracted from different wastes by boiling them with water and acids as specified below (Table 1). The biochemical characters analyzed were anhydrouronic acid (%), methoxyl content (%), gel grade and acetyl value (%), using standard procedures (Ranganna, 1986). The results are given in Table 2.

The dominant and unifying structural feature in pectins is a linear 1,4-alpha linked D-galacto-pyranosyl uronic acid chain. Pectin, which is a partly esterified polygalacturonide, contains 10 per cent or more of organic materials, composed of arabinose, galactose or sugars. AUA (%) is essential to determine the purity and degree of esterification and to evaluate physical properties (Ranganna, 1986). The higher galacturonic acid and lower ash content are the two criteria governing its purity (Hwang *et al.*, 1992).

It is evident from the data generated on AUA % of pectin from different fruit wastes (Table 2) that purest pectin could be obtained from mangosteen rind and lime peel, compared to other sources. The AUA% for mangosteen rind pectin was 73.16 and for lime peel pectin, it was 72.5%. Among these two, mangosteen is a weaker source of pectin, whereas lime peel is the commercial source. The value of AUA % obtained for lime peel pectin is approximately same as that reported by Sudhakar and Maini (1999), which was 71.2 per cent.

The pectins have commercial uses as agglutinator in blood therapy (GITCO, 1999) and also as thickening agent in medium used for canning of meats. For these purposes, pure pectins are required. Thus the source of pure pectin identified in the present study has relevance in blood therapy as well as in food preservation industries.

Passion fruit rind recorded the lowest AUA (%), viz., 46.17. It can be assumed that the galacturonic acid in pectin of passion fruit rind is low and other forms of sugars such as arabinose, rhamnose etc. predominate.

All the sugars viz, arabinose, galactose, galacturonic acid and rhamnose, which are structural components of pectin, have free hydroxyl groups (-OH) that can be methylated to form methoxyl groups (-OCH3) (methylation). Depending upon the degree of methylation, the methoxyl content of pectin varies. The spreading quality and gel grade of pectin are dependent of their methoxyl content.

Gel grade is the weight of sugar with which one part by weight of pectin will, under suitable conditions, form a satisfactory jelly. This is the most important character that determines the value of pectin in international market. As the methoxyl content increases the spreading quality and sugar binding capacity of pectin increase.

In the present study, the gel grade of pectins with methoxyl content in the range of 8 to 11 per cent (pectin from pumello peel, lime peel and mangosteen rind) was found to vary from 200 to 213. Highest gel grade was obtained for lime peel pectin (213), followed by mango peel pectin

Table 1. Method of extracting pectin from different fruit wastes

Wastes	Quantity of water added (l/kg of waste)	Quantity of acid used (g/kg of waste)	Boiling time, rain
Mango peel	3.0	Citric acid, 7.5	60
Jack fruit	1.5	Citric acid, 7.5	45
Banana peel	1.5	Citric acid, 7.5	60
Nut meg rind	1.5	Citric acid, 7.5	45
Pumello peel	1.5	HCl 0.1*N*, 5.0	45
Passion fruit rind	3.0	Citric acid, 7.5	45
Lime peel	3.0	Citric acid, 5.0	60
Mangosteen rind	1.5	HCl 0.1*N*, 5.0	45

Table 2. Variability in AUA, methoxyi content, gel- grade and acetyl value of pectin extracted from fruit wastes

Fruit wastes used for pectin extraction	AUA (%)	Methoxyi content (%)	Gel grade (%)	Acetyl value (%)
Mango peel	56.67	7.33	199	-
Jackfruit rind	66.00	7.67	159	-
Banana peel	53.00	7.03	99	-
Nutmeg rind	59.50	7.49	167	-
Pumello peel	64.17	8.57	202	-
Passion fruit rind	46.17	4.96	73	-
Cocoa pod husk	52.84	6.97	129	1.2
Lime peel	72.50	9.92	213	-
Mangosteen rind	73.16	10.54	171	-
Mean	60.45	7.94	157	-
CD (0.05)	0.82	0.39	4.28	-
SEm±	0.41	0.19	1.49	-

(199). These results are in corroboration with Sudhakar and Maini(1999)
It can be inferred that they posses good spreading and sugar binding capacity. Pectins from passion fruit rind with methoxyi content 4.96% recorded low gel grade (73). Gel grade was in the range of 100 to 200 **for** those having methoxyi content in between seven and eight per cent.

Properties of pectin in cell walls are sometimes modified by low levels of hydroxyl esterification with acetyl groups. The distribution of acetyl groups in pectin is unknown but in sugar beet, pear and apricot pectin, acetyl levels are reported to approach four per cent (Ranganna, 1986).

Sugar beet pectin contains acetyl group. Perhaps other pectins may also contain this group. If acetyl group is present in pectin, it inhibits jelly formation. In the present study, hydroxyl esterification with acetyl group was not obtained for any pectin extract except that for cocoa pod husk

College of Horticulture
Vellanikkara, Trichur 680 656, India

Apsara Madhav
P. B. Pushpalatha

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