EXTRCTION AND CHARACTERIZATION OF PECTIN FROM YELLOW PASSION FRUIT (*Passiflora edulis f.flavicarpa L)* ENDOCARP PEEL

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ABSTRACT

Passion fruit (*Passiflora edulis f.flavicarpa L)* peel, a waste from fruit industry could be utilized to extract pectin. The objectives of this study were to extract and isolate pectin from passion peel and compare its physico-chemical properties to that of commercial pectin.Pectin was extracted from passion fruit endocarp after pre-processing, at pH 1.34 and at 65°C, for 2 h. and filtered and isolated by precipitating with 96% Ethyl Alcohol. The filtrate was washed with acidified ethanol, absolute ethanol and air dried at 40-45°.The yield of passion pectin was 29% (dwb). Passion pectin contained significantly higher methoxyl content (9.88%±0.03), acetyl value (1.9%±0.03) and uronic acid content (89.6%±0.16) than that of commercial pectin (8.16%±0.03, 1.53%±0.02 and 76.19%±0.33 respectively). Degree of Esterification (DE) (71.44%±0.67) and equivalent weight (810.85±7.63) of passion fruit pectin was significantly lower than commercial pectin (76.41%±0.72, 1271±18.4). Both pectins are classified as high methoxyl (>7% methoxyl content and >50% DE) and as rapid set (<25min.). Gel-forming property of passion pectin at 110 gel grade was of good quality than commercial pectin at 150 gel grade.

***Key words*:** acetyl value, commercial pectin, Degree of Esterification, methoxyl content, passion pectin

1. INTRODUCTION

Pectins are structural polysaccharides present within all dicotyledonous plant cell walls. The primary structural feature of pectin is a linear 1, 4 α linked D-Galacturonic acid chain with varying degrees of methylation. The main raw materials used to produce commercial pectin are apple pomace and citrus peel, **Wang *et al*** [1].

Passion fruit (*Passiflora edulis f.Flavicarpa*) which belongs to the family Passifloraceae is an exotic fruit with a characteristics flavour. It is a commercially important fruit successfully grown in most of the tropical and sub tropical regions of the world. Passion fruit is also widely cultivated in Sri Lanka.

Passion fruit juice and juice concentrates are popular processed fruit products in the world market. The waste generated during processing of passion fruit mainly consists of peel and seed. Passion fruit peel represents nearly half of the fruit mass. It is a major waste, that posses the problem of disposal with causing environmental pollution. Therefore it is necessary to turn the peel into useful byproducts. Prasad [2] reported that the Passion peel contains significant quantity of pectin.

The objectives of this study were to extract and isolate pectin found in passion peel and to study the physical and chemical properties of passion pectin extracted from passion fruit and to compare these properties with that of commercial pectin.

2. MATERIALS AND METHODS

2.1 Materials

All the chemicals used in the study were of analytical grade. Mature, undamaged and healthy yellow colour passion fruits were collected from the local market.

2.2. Methods

2.2.1. Pre processing procedure

Yellow Passion fruits were washed with water and cut into halves up on the removal of seeds. Endocarp (inner material) was then scooped out after steaming peels at ambient pressure for half an hour. Endocarp was dried in the dryer after the removal of outer coat. It was then ground to get dried endocarp peel powder.

2.2.2. Extraction of pectin from dried endocarp powder:

Yellow passion fruit endocarp powder was weighed into a beaker and distilled water was added at 1:15 ratio. The mixture was stirred to dissolve the peel powder in water. Then the pH of the mixture was measured and adjusted to pH 1.34 using 0.5N Hydrochloric acid. Then the mixture was heated at 65 to 75 °C for 2 hour and filtered when it is hot. The filtrate was cooled to room temperature, and 96% ethanol was added at 1:2 ratio to the filtrate. Then it was left to precipitate pectin for 16 hours. After precipitation of pectin in ethanol, the

precipitate was filtered and firstly washed with acidified 70% ethanol, secondly by 70% ethanol and finally 96% ethanol and got the washed pectin. Then it was dried in an oven at 40°C to obtain constant weight. Finally the percentage of pectin in dried peel was calculated.

Uronic acid content was estimated using the method explained by Bitter and Muir [3]. Methoxyl content, Degree of esterification, Equivalent Weight, Acetyl value, Gel grade and Gel setting time were estimated by the method explained by Ranganna [4]. It was done for both commercial and passion fruit endocarp pectin were determined.

2.2.3. Statistical Analysis

All results were analyzed by Randomized Complete Block design (RCBD) using SAS analytical package.

3. RESULTS AND DISCUSSION

3.1. Yield of pectin

Passion fruit endocarp powder yielded 29% pectin on dry basis. This yield was comparable to the yields reported by Nelson *et al* [5] for commercially used raw materials of citrus (30-35%) and apple pomace (15-20%). Previous studies conducted by Kulkarni [6] revealed that passion fruit peel yields 14.8% pectin when HCl is used as extracting agent As compared to this result, our results showed a higher yield of pectin. Passion fruit endocarp is a potentially good source of pectin.

3.2. Purity of pectin

The purity of pectin can be determined by the content of galacturonic acid present in the sample. Pectin from passion fruit endocarp showed significantly ($P<0.05$) higher Anhydrogalacturonic acid (AUA) content (89.62±0.16%) than that of commercial pectin (76.19±0.33%). Purity of passion fruit endocarp pectin was higher than that of commercial pectin.

3.3. Physical and chemical properties of pectin

Table1: Physical and chemical characteristics of commercial pectin and passion fruit endocarp pectin

Characteristics	Commercial pectin	Passion endocarp pectin
∗Methoxyl content %	8.16±0.03	9.88±0.03
∗Degree of Esterification%	76.41±0.72	71.44±0.67
∗Acetyl value %	1.53±0.02	1.86±0.03
∗Uronic acid %	76.19±0.33	89.62±0.16
∗Equivalent Weight	1271±18.4	810.85±7.63
Gel grade	150	110
Gel setting time	<25 min	<25min

∗ Results were presented as a mean of three replicates

The methoxyl content of yellow passion fruit endocarp pectin (9.88%±0.03) was significantly higher than that of commercial pectin (8.16%±0.03). Apsara [7] Reported that the sugars such as arabinose, galactose, galacturonic acid and rhamnose are the structural components of pectin from fruit peel , which have free hydroxyl group (-OH) that can be methylated to methoxyl groups ($-OCH_3$) and the methoxyl content of pectin can vary with the source of raw material used for the extraction of pectin. Whistler and Bemiller [8] reported that methylation increases the capacity to form gels.

Degree of esterification was significantly higher in commercial pectin (76.41%±0.72) than that of passion fruit endocarp pectin (71.44%±0.67). The value of the DE of passion fruit pectin (71.44%) was similar to the value reported by Corona *et al.* [9] (71.6%), using HCl in the extraction procedure. Thakur *et al* [10] reported that depending on degree of esterification, pectin is divided into two major groups: high-ester pectin, with degree of esterification higher than 50%, and low-ester pectin, with degree of esterification lower than 50%. Based on their classification, both commercial and passion fruit endocarp pectins are classified as high methoxyl (HM) pectin (Methoxyl content >7% and DE >50%).

Acetyl value was significantly high in passion fruit endocarp pectin (1.86%±0.03) than commercial pectin (1.53%±0.02). Further, Ranganna, [4] reported that the gelling capacity of pectin decreased with increase in the degree of acetylation. If acetyl group is present in pectin, it inhibits jel formation. Schultz [11] reported that samples containing 3.5%-4.0% acetyl gives weak gels while gelling power restored at levels around 2.4% acetyl.

3.4. Gelling characteristics of pectin

The chemical and physical properties of pectin measure the behavioural properties that correlate with its applicability in food formulations. Gelling characteristics of pectin is determined by the chemical characteristics of pectin.
If the jel sets in 10- 25 min, the pectin is considered as ‘rapid setting’ and if the time required for the setting of jel is more than 25min, it is ‘slow setting’.

It was reported by Ranganna [4]. **Table 1** shows that the setting time of passion endocarp pectin and commercial pectin was below 25min, therefore, these two pectins are 'rapid setting' pectins.

The pectin of passion fruit was high methoxyl (HM) and rapid set type pectin. Therefore, it was able to form gel. May [12] reported that the gelation occurs by lowering the pH to 3.2-3.4 and in the presence of 65% soluble solids According to the quicker gel, passion fruit pectin can be used satisfactorily within a given time according to the requirement.

Commercial pectin formed jel at 150 grade, that is ideally suited for jel making. But passion fruit pectin did not form firm jel at this grade. Therefore the experiments were repeated at gel grade 140. (Gel grade is defined as the quantity of pectin which when used with a unit amount of sugar, will produce as standard gel). At 140 gel grade jel did not set. So this experiment was repeated until it formed a firm jel. At 110 grade firm jel was formed for passion fruit endocarp pectin. Comparisons of gel grade are only valid when the extraction method employed is the same, as gel grade is much affected by the method of extraction. Jel was formed with sugar content (65-75%) and at pH 3.0. In addition to the strength of the gel, setting characteristics and the degree of methylation of the carboxyl acid group in the molecule are also vital important factor to determine the industrial application of pectin.

Results showed that pectin from passion endocarp can form gels similar to that formed with commercial pectin. An interesting observation was that passion gel was not very transparent like citrus jel due to the colour.

4. CONCLUSION

Passion fruit endocarp pectin was found to be a good source for pectin, with yield of approximately 29% on dry weight basis when extracted using the dried endocarp peel powder. Purity of passion pectin (AUA-89.62%) was higher than commercial pectin (AUA-76.19%). Pectin from passion fruit endocarp contains more than 50% of carboxyl group esterified with methanol (HMP). Passion endocarp pectin showed better gel forming characteristics at 110 gel garde. The pectin from passion peel was quite highly coloured due to the presence of polyphenols or other water soluble pigments trapped inside the pectin during precipitation.Hence, decolorization techniques need to be incoperated for the extraction of pectin from passion peel to get pectin with better colour. Determination of neutral sugars associated with passion endocarp pectin by the use of Gas Chromatography techniques, will be helpful to signify its side chain.

5. REFERENCES

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