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ISOLATION AND CHARACTERIZATION OF PECTIN EXTRACTED FROM PAPAYA, TAMARIND AND BANANA PEELS PURCHASED FROM LOCAL MARKET OF RAJKOT, GUJARAT, INDIA

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ABSTRACT :

The research was conducted to find out the various extraction conditions of pectin from papaya, tamarind and banana peels under different of solvents (citric acid and methanol). The Preliminary results showed that pectin was extracted in acidic aqueous medium (pH 1.5 - 3) between 75º - 100ºC for 1 - 3 hours with continuous stirring. The pectin was isolated successfully. The diverse characteristics such as yield, content of moisture, methoxyl and ash equivalent weight, degree of esterification and methoxyl contents of extracted pectin were varying depending upon the sources of pectin. These tests and calculation validated the accuracy suitability of extracted pectin.

KEYWORDS : *Papaya Peels, Tamarind Peels, Banana Peels, Pectin, Maturity Stages, Solvents, Temperature.*

1. INTRODUCTION

Pectin word is derived from the Greek meaning "congealed/curdled" and it belongs to the group of Polysaccharide and contained the 300 - 1,000 chains of galacturonic acid units. It is located in the cell walls as well as middle lamellae of higher plants. (Yeoh *et al.,* 2008; Levigne *et al.,* 2002). In 1825 Henri Braconnot first isolated pectin. Till date, there is several companies are working on pectin production. It is also used in pharmaceutics, food industry as a stabilizer.

Pectin is widely used in the food industry as a thickener, dessert fillings, emulsifier, texturizer and stabilizer in fruit juices and milk drinks as well as gelling agent in jams and jellies as a fruit drink concentrates (Tsoga *et al.,* 2004). Pectin is widely used as a medicine to lower blood cholesterol. Dietary products prepared from pectin fiber contained the properties of prevention of hyperlipidemia as well as bowel cancer (Iglesias and Lozano, 2004).

Water, Mineral acids and diverse acids are used to extract the pectin. Water, Mineral acids were used to extract high methoxyl pectin and hydrochloric, nitric, sulphuric and phosphoric acids were used to low methoxyl pectin various factors such as extraction time, temperature, pH and types of extraction solvent (Zhang and Taihua, 2011). The aim of this study to the extraction procedure and characterization of pectin with good yield from local fruits such, papaya, tamarind and banana peels.

2. MATERIALS AND METHOD

2.1. COLLECTION OF SAMPLES

Fresh papaya, tamarind and banana peels were collected from the local market of Rajkot, Gujarat (India).

2.2. SAMPLE PREPARATION

Fresh fruit samples were cleaned with tap water to remove any foreign material. Then samples were cut into slices (2 - 3 mm thickness). It was air dried in a shady place, after that it was homogenized to fine powder using a grinder (mixture) and stored in airtight containers. Samples were stored in cool places and used for extraction and analytical studies.

3. EXTRACTION OF PECTIN

3.1. OPTIMIZED CONDITIONS

A citric Acid used for extraction of pectin. 5 gm of sample dried powder was weighed and placed in a beaker containing 250 ml of water. The extraction medium pH 1.5 was adjusted by adding required citric acid. The mixture was heated while stirring at 100°C for 90 min. After heating, the extract was filtered and allowed to compress the extract. The filtrate was cooled at 4°C. Then the filtrate was precipitated by adding methanol (95% - 98%) of equal volume as the extract and kept for one hour. The coagulated pectin was put in Petri dishes and kept in a hot air oven at 45°C overnight. Further characterization of extracted pectin was carried out.

4. CHARACTERIZATION OF PECTIN

4.1. DETERMINATION OF PECTIN YIELD AND MOISTURE CONTENT

The yield of pectin and moisture content were calculated by the method given by Ranganna, 1995.
For pectin yield :

$$\text{Pectin (g/100)} = \frac{\text{Weight (g) of dried pectin}}{\text{Weight (g) dried pomance powder taken for Extraction}} \times 100$$

For moisture content :

$$\text{Moisture \%} = \frac{W1 - W2}{W1 - W} \times 100$$

Here,

W = Weight of Petri dish (g).
W1 = Weight of Petri dish with sample (g).
W2 = Weight of Petri dish with dried sample (g).

4.2. ALCOHOL TEST (GELLING TEST)

Take 1 ml sample on a Petri dish; mix it with 3 ml alcohol (Rubbing alcohol, not safe for drinking). Leave it for a few minutes till clotting is formed. If a single clot is formed, it indicates that the sample consists of pectin.

Figure 1. Alcohol Test

4.3. DETERMINATION OF EQUIVALENT WEIGHT AND METHOXYL CONTENT

Equivalent weight and Methoxyl content were carried out by Ranganna's method, 1995.

For Equivalent weight :

$$\text{Equivalent weight} = \frac{\text{Weight of Sample} \times 1000}{\text{ml of alkali} \times \text{Normality of alkali}}$$

For Methoxyl content :

$$\text{MeO\%} = \frac{\text{Meq. of sodium hydroxide}}{\text{Weight of sample (mg)}} \times 31 \times 100$$

4.4. DETERMINATION OF ANHYDROURONIC ACID CONTENT (AUA)

Total AUA content of pectin was calculated from a formula given by Mohamed & Hasan, 1995.

$$\text{AUA (\%)} = \frac{176}{Z} \times 100$$

Here, 176 is the molecular weight of AUA.

$$\text{\% of AUA} = \frac{176 \times 0.1\,z \times 100}{w \times 1000} + \frac{176 \times 0.1\,z \times 100}{w \times 1000}$$

When molecular unit of AUA (1 unit) = 176 gm

Where,

z = ml (titre) of NaOH from equivalent weight determination.

y = ml (titre) of NaOH from Methoxyl content determination.

w = weight of sample

4.5. DETERMINATION OF DEGREE OF ESTERIFICATION (DE)

The DE of pectin was measured as per method described by Owens *et al.,* 1952).

$$\text{\% DE} = \frac{176 \times \text{MeO} \times 100}{31 \times \text{\% AUA when molecular unit of AUA (1 unit)} = 176\ \text{gm}}$$

$$\text{\% DE} = \frac{176 \times \text{MeO} \times 100}{31 \times \text{\% AUA}}$$

5. RESULTS AND DISCUSSION

Pectin was extracted in acidic aqueous medium (pH 1.5 - 3) between 75º - 100ºC for 1 - 3 hours with continuous stirring. The pectin was successfully extracted from papaya, turmeric and banana peels.

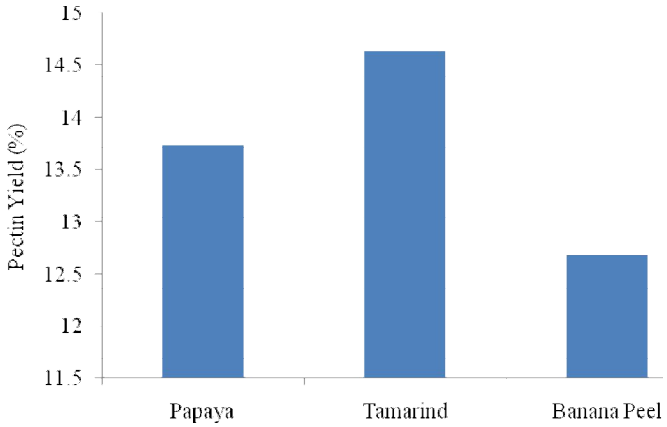
Figure 2. Extracted pectin

We used citric acid instead of mineral acid to avoid environmental issues and began to work in the field of green chemistry. Although organic acids showed less hydrolysis as compared to mineral acids.

5.1. DETERMINATION OF PECTIN YIELD AND MOISTURE CONTENT

5.1.1. DETERMINATION OF PECTIN YIELD

The Total yield of pectin obtained from Papaya, Tamarind and Banana peel was 13.75%, 14.64% and 12.69% respectively.

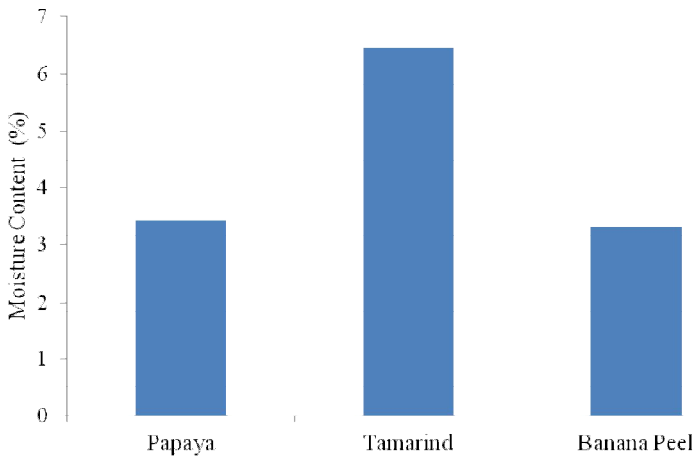


Graph 1. Pectin Yield

Azad *et al.,* 2014 obtained the pectin yield of 13.13% + 0.17% from premature lemon pomance. The pectin yield significantly depends on ripening condition of fruit, source of extraction as well as the methods of extraction (Rha *et al.,* 2011).

5.1.2.DETERMINATION OF MOISTURE CONTENT

The moisture content of each sample was in range of 3.33% to 6.4%. Isamil *et al.,* 2012 reported the moisture content of dragon fruit pectin was in the range from 11.13% to 11.33%.



Graph 2. Moisture Content

The source of pectin should have lower moisture content. Higher moisture favors the growth of microbes, fungi and displays the activities of pectinase. The pectinase activities are inversely proportional to pectin yield.

5.2.ALCOHOL TEST (GELLING TEST)

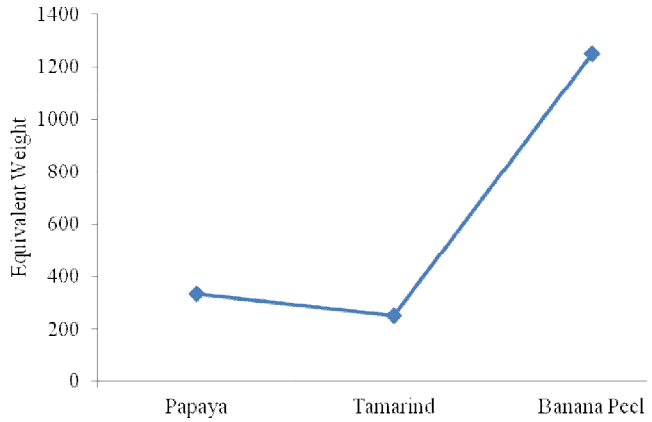
The sample with high pectin formed a solid jelly-like substance that is dense enough to be lifted with a spatula. This indicated the presence of significant amount of pectin in sample and its gelling property.

Figure 3. Alcohol Test

5.3. DETERMINATION OF EQUIVALENT WEIGHT AND METHOXYL CONTENT

5.3.1. DETERMINATION OF EQUIVALENT WEIGHT

The equivalent weight of extracted pectin from papaya, tamarind and banana peel was 333.3, 250 and 1251 respectively.

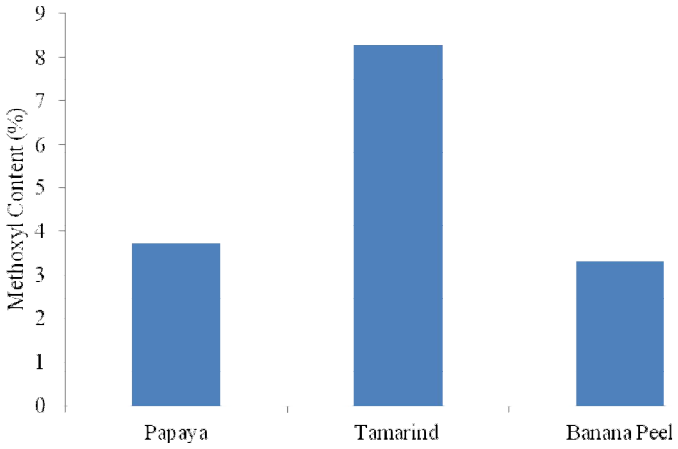


Graph 3. Equivalent weight

Our results showed the equivalent weight of pectin in the range of 220 to 1251. The range of our result relatively similar with pectin from apple pomace was 833.33 to 1666.30 (Kumar & Chauhan 2010). The equivalent weight of pectin was strongly dependent on the source of pectin, method of extraction of pectin, maturity stage, ripening condition of sources as well as amount of free acids.

5.3.2.DETERMINATION OF METHOXYL CONTENT

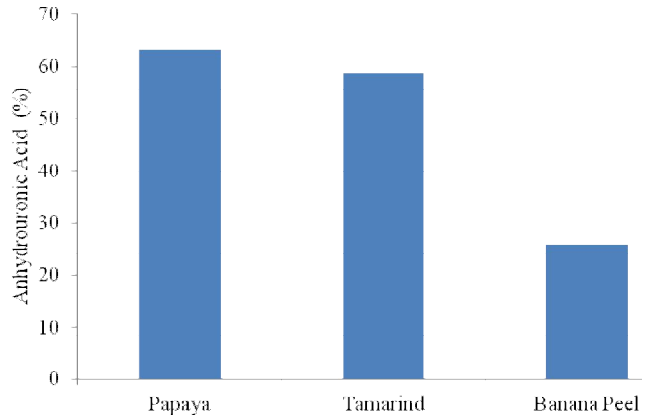
A Methoxyl content of extracted pectin from papaya, tamarind and banana peel was 3.72%, 8.29%, and 3.33% respectively.



Graph 4. Methoxyl content

5.4. DETERMINATION OF ANHYDROURONIC ACID CONTENT (AUA)

The obtained results represented the Anhydrouronic Acid content of pectin extracted from papaya, tamarind and banana peel was 63.36%, 58.78% and 26.04% respectively.

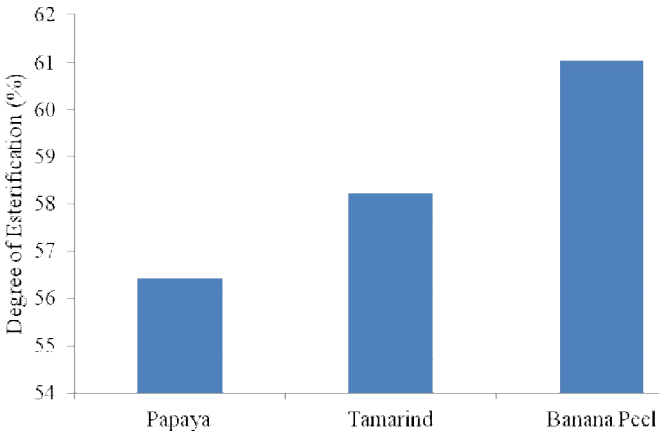


Graph 5. Anhydrouronic Acid

As per the AUA value should not be less than < 65%. The AUA value represented the extracted pectin is inversely proportional to the amount of protein. The value of commercial apple pectin was 59.52 to 70.50% (Kumar & Chauhan 2010). Our result depicted the resembled value in the range of 26.04 to 63.36%. Azad *at el.,* 2014 group reported AUA value was observed significantly different in a premature as well as mature sample of lemon.

5.5.DETERMINATION OF DEGREE OF ESTERIFICATION (DE)

The Degree of Esterification of pectin from Papaya, Tamarind and Banana peel was 56.43%, 58.23% and 61.06% respectively.



Graph 6. Degree of Esterification

DE is a significant parameter which decides the gelling property of pectin. Pectin is divided into two groups based on DE. Pectin with DE higher known as high Methoxyl pectin and DE lower known as and low Methoxyl pectin.

This analytic tests such as pectin yield, equivalent weight and methoxyl content, calculates the accuracy, applicability as well as the properties of the extracted pectin.

6. CONCLUSION

This study investigated the potential of three Papaya, Tamarind, and Banana peel for the extraction of pectin. Chemical characteristics of extracted pectin such as moisture content, degree of Esterification and equivalent weight. The result reveled that extracted pectin reported with good quality. The extracted pectin from local fruits magnifies its potential use as an alternative source of commercial pectin production.

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CONFLICT OF INTEREST

No conflict of interest related to the study.

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