IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Different Techniques for Extraction of Pectin from Orange Rind

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Abstract: Pectin is a complex polysaccharide which is found abundantly in green plants. It is extracted mainly from fruits and vegetables, notably citrus fruits. Typically citrus skin has frequently been ideal substance for pectin production owing to its high pectin substance and superior coloring property. Mostly orange, lemon and lime peel are the sources preferred of citrus pectin. It is utilized in food and pharmaceutical industries. Pectin is employed as a gelling agent in jams and jellies. This review article is about, extraction of pectin from orange peels. There are several extraction methods like microwave assisted extraction method, ultrasound assisted extraction method and enzyme assisted method. In this work acid based extraction is discussed, as it gives high yield compared to other methods. The extractions were carried out in various time and temperature combination. The extracted pectin was dried and analyzed for its composition.

Index Terms **- pectin, orange peel, acid based extraction, alcohol precipitation**.

I. INTRODUCTION

Pectin is a heteropolysaccharide compound mostly found in cell wall, primary and middle lamella of green plants. A French chemist named Henry Barconnot discovered and isolated pectin in1825. It is made up of galacturonic acid which is a sugar derived from galactose. It is extracted abundantly from citrus fruits. Pectin helps to bind the cells of the middle lamella together. The quality, quantity, structure and chemical composition of pectin varies with various plants and various plant parts. When a fruit is ripened, pectin is broken down by enzymes named pectinase and pectin methyl esterases. Pectin is widely used in food industry as gelling agent, thickener, texturizer, as a stabilizer and also as an emulsifier. It is also used widely in pharmaceutical industry along with food industry as a thickening and gelling agent [6].

II. STRUCTURE

Pectin is an odorless heteropolyssacharide compound which is rich in β-D-Galacto pyranuronicacid. The structure of the pectin changes during extraction from plant, during isolation, storage, processing hence it is difficult to determine [7]. The chemical formula of pectin is $C_6H_{10}O_7$ with an average molecular weight of 194.1394. The major component of pectin is galacturonic acid. Galacturonic acid is an oxidized form of D-galactose which is a C-4 epimero f glucose.

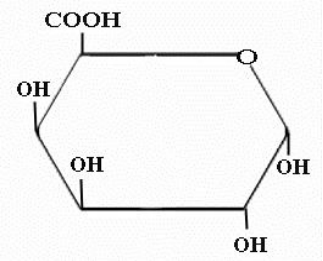

Fig. 1: Structure of pectin

Pectin is a natural thickener and gelling agent, is often similar to gelatin. It is a soluble fiber and forms gel in human digestive tract. When dissolving pectin, available liquid is trapped and gel is formed. Based on the degree of esterification and presence of carboxyl group of galacturonic acid, pectin is classified into High Methoxy Pectin (HMP) and Low Methoxy Pectin (LMP) [11]. The high methoxy pectin is further classified into rapid set and slow or medium set. The gelation of pectin is controlled by their Degree of Esterification. Degree of esterification is different for high methoxy pectin and low methoxy pectin. The degree of esterification for high methoxy pectin is above 50% while for low methoxy pectin is less than 50% [5]. High methoxy pectin forms gel in the presence of sucrose [1]. Low methoxy pectin forms gel in the presence of calcium. The source together with the extraction condition has an impact on the molar mass, acetyl esterification and degree of esterification. Pectin is used widely other than being a gelling agent in various fields and has found various applications in recent times [9].

III. EXTRACTION TECHNIQUES

3.1 Microwave Assisted Extraction of Pectin [10]:

The microwave extraction method works on the principle of dielectric heating of the plant base material by the process of exposing it to the microwaves radiation. Dipolar rotation of the water inside the plant molecules forms heating effect by absorbing the electro-magnetic radiation. The microwave energy is absorbed by the polar solvent. It has two oscillating perpendicular fields, magnetic and electric fields which cause electromagnetic radiation [4]. The pectin esterase enzymes are disabled due to the exposure of heat produced by the microwave and this inactivation leads to increase in extraction or yield of the pectin. Increase in microwave radiation leads to increase in solvent penetration resulting increased in pectin extraction. Water acts as a polar solvent and performs the heating process proficiently. Sudden increase in temperature inside the plant cell causes rise in core pressure leading to break the cell and destruction of sample enabling the extraction process and improving the yield. When compared to conventional heating microwave heating seems to have increased efficiency. Further no more noteworthy variance is observed between conventional techniques and microwave assisted technique other than moisture and ash content.

3.2 Acid Based Extraction Method

The pectin which is tightly bound to the cell membrane of plants is extracted by the acids. The acids are said to be the sturdiest extracting agents. Acids like citric, acetic, nitric, hydrochloric, sulfuric, oxalic, malic, phosphoric and organic tartaric can be used for extraction process. The acid based extraction method is carried out in a water bath with the addition of acid to the solution. In the method the extraction process is carried out under reflux using acidified water at 70 degree Celsius for 2 hours. The acid based extraction method is the strongest extraction methods. The acids infiltrate deep into the cell matrix enhancing the extraction process by loosening the tightly bound insoluble pectin to facilitate extraction process. The extraction with addition of citric acid was found to produce low yield while with sulfuric acid and hydrochloric acid was found to produce higher yield for most of the fruits. It is said that acid based extraction may result in degradation and reduced gelling properties [10].

3.3 Enzymatic Extraction [10]:

Enzymatic extraction involves enzymatic reaction to vitiate the cell wall and isolate the pectin from the cell walls and plant membranes. Several enzymes like polugalacturonase, cellulose enzymes, protease, xylase, amylase, neutrase and pectinesterase are used to isolate pectin from cell membranes. The physiochemical properties of the pectin are modified by these enzymes facilitating the extraction process.

3.4 Ultrasonic Assisted Extraction Method [4]:

Ultrasonic extraction method is a non-conventional method which comparatively reduces extraction time and temperature. The sound waves pass through the medium regularly liquid in state resulting in expansion and compression of the medium. The high temperature and pressure formed by the compression and expansion causes the microscopic particles to allow the extractor solvent with enhanced penetration rate to improve the efficiency of the yield.

IV. ACID BASED EXTRACTION METHOD

4.1 Materials and Methods

Orange peel, 0.1M Hydrochloric acid, 99% Ethanol and Distilled water were used for extraction process. Mature orange fruits assortment is done washed and substantially inspected for their cleanliness and wholesomeness. The fruits were cut into fragments and their peels removed. The peels were cut into small pieces and washed with ethanol to ensure their hygiene. They were then dried in a tray drier and grind into powder as once they are cooled. This peel powder was further used for extraction process [8].

4.2 Procedure:

The 50g of dried orange peel powder was transferred into a beaker containing 250ml of water and 5ml of 0.1M Hydrochloric acid. The solution was boiled for 2 hours at 75 degree Celsius in a water bath with constant stirring. The boiled solution was cooled and filtered with cheese cloth to remove residues and excess HCL. The filtrate was taken in a beaker. 99% reagent ethanol was added to the beaker and stirred thoroughly followed by allowing it to stand for 30 minutes. The precipitated pectin in jelly form with the

addition of ethanol was skimmed off and washed with ethanol to ensure the complete elimination of the HCL [2]. The extracted jelly pectin was dried and powdered.

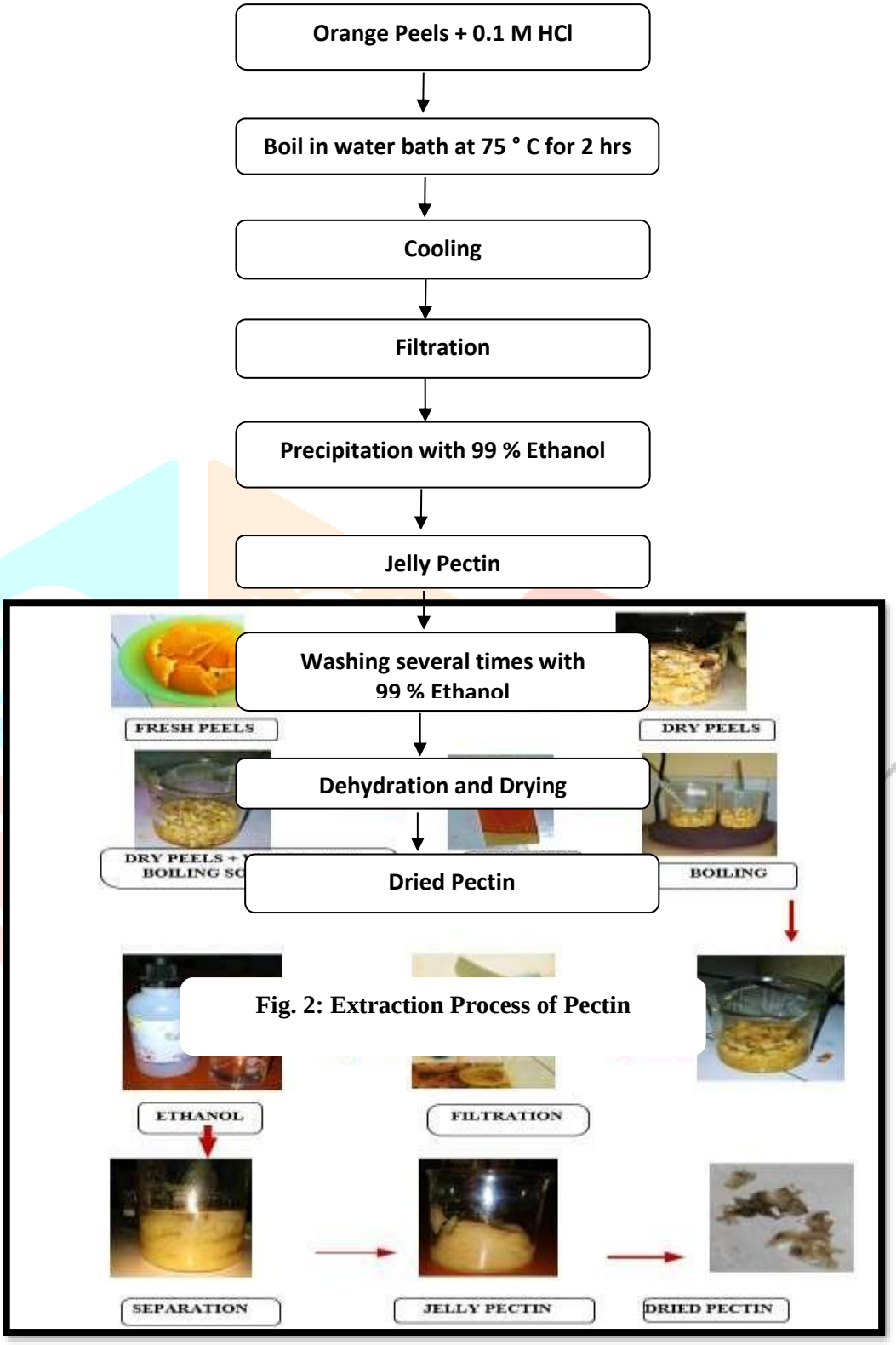

Fig. 2: Extraction Process of Pectin

Fig.3: Processing and Extraction of Pectin from Orange Peels

4.3 Analysis of Extracted Pectin

4.3.1 Color of the pectin:

The dried pectin was look at visually to find its actual color and is recorded [2-3].

4.3.2 Solubility in hot and cold water:

The dried pectin samples were taken in a conical flask. It was stirred together with ethanol and distilled water with a magnetic stirrer followed by continuous heating to find the solubility of the pectin in water [2-3].

4.3.3 Equivalent weight determination:

0.5g of pectin was weighed in a conical flask. The pectin was wetted with 5ml of ethanol and 1.0g of sodium chloride with 100ml of distilled water and phenol red indicator. Mix it thoroughly until all the particles are dissolved completely without any clumping occurring. The mixture was then titrated against 0.1M NaOH to get pink color end point [2-3].

$$\text{Equivalent weight} = \frac{\text{Weight of the pectin sample}}{\text{Volume of NaOH} \times \text{Molarity of NaOH}} \times 100$$

$$= (0.5/3*0.1)*100 \qquad = 166.67g$$

4.3.4 Moisture content:

1`g of pectin was weighed, in a crucible and heated in a muffle furnace for 1 hour. The petri dishes were cooled in a desiccator weighed and recorded [2-3].

$$\text{Moisture content} = \frac{\text{Weight of the residue}}{\text{Weight of the sample}} \times 100$$

$$\text{Moisture content (\%)} = (0.7/1)*100$$
$$= 70\%$$

V. FACTORS AFFECTING THE PECTIN PRODUCTION

5.1 Temperature:

The yield of the pectin can be examined at various temperatures. The yield seemed to be high at higher temperature than the low temperature. But the yield was found to be higher on moderate temperature when compared to both high and low temperature [7].

5.2 Agitation rate:

The yield of the pectin was found to be high with higher agitation rate. As continuous stirring, results in reducing the thickness of the diffusion layer and making it possible to improve the extraction rate [7].

5.3 pH:

The pH value plays an important role in affecting the pectin production. When pH value increases the pectin production decreases. With decrease in pH range increased pectin production is observed [7].

5.4 Time of extraction:

The yield of pectin is increased with increase in extraction time up to a limit. Due to thermal degradation the yield decreases with the time after it reached the extreme temperature [7].

VI. CONCLUSION

The extraction of pectin from orange peels by acid based extraction method gives an idea describing the extraction of pectin from fruit based waste material. The pectin extracted from different techniques tends to have different physiochemical properties and qualities. It can be implicit that each technique has its own qualities and demerits. Different extraction techniques and factors distressing the extraction process have been studied. Pectin is extensively used in food and pharmaceutical industries as a gelling agent, emulsifiers, gene and DNA carriers etc. In recent times a wide range of industries have been developed with various extraction methods. Researches are still in progress to find the way for increasing the yield of pectin in production. In future we may expect many innovative methods for extraction of pectin. The upshot of the present work tinted that the oranges are superior source of pectin and does have the prospective to turn out to be significant raw material for food processing industries. Orange fruit peel pectin extracts are most important and widely utilized in food processing sector, pharmaceutical and conventional gelling technique for jam and jellies.

REFERENCES

1. Aina, V. O., et al. 2012, “Extraction and Characterization of Pectin from Peels of Lemon (Citrus lemon), Grape Fruit (Citrus Paradisi) and Sweet Orange (Citrus Sinensis).” British Journal of Pharmacology and Toxicology.
2. Bagde, Prashansa P., Sumit Dhenge, and Swapnil Bhivgade, 2017, “Extraction of Pectin from Orange Peel and Lemon Peel”, International Journal of Engineering Technology Science and Research.
3. Devanooru Krishnamurthy Bhavya, Shrilakshmi and Rao Suraksha, 2015, “Value Added Products from Agriculture: Extraction of Pectin from Agro Waste Product Musa Acuminata and Citrus Fruit”, Research Journal of Agriculture and Forestry Sciences.
4. Harshadashinde, 2022, “Extraction of Pectin from Orange Peels: A review” Journal of Emerging technologies and innovative research.
5. Joye, D.D., Luzio, G.A., 2000. “Process for Selective Extraction of Pectin from Plant Material by Different pH” .carbohydrate polymers.
6. May, Colin D. 1990. “Industrial Pectins: Sources, Production and Applications.” Carbohydrate polymers.
7. Nitin G Kanse, Shah Chirag, Salunkeswapnil, Suryawanshivishal, 2017, “Extraction of Pectin from Orange Peels and its Application: A Review” International Journal of Innovative Research in Science, Engineering and Technology.
8. Panchami P.S, Gunasekaran.S, 2017, “Extraction and Characterization of Pectin from Fruit Waste”, Int. J. Curr. Microbiol. App. Sci.
9. Pandharipande, Shekhar, and Harshal Makode. 2012, “Separation of Oil and Pectin from Orange Peel and Study of Effect of pH of Extracting Medium on the Yield of Pectin”, Journal of Engineering Research and Studies.
10. Sandarani MDJC, 2017, “A Review Different Extraction Technique of Pectin”, J Pharmacogn Nat Prod.
11. Willats, W.G.T.,McCartney, L., Mackie, W., and Knox, J.P., 2001, “Pectin : Cell biology and Prospects for Function Analysis”, Molecular Biology.