Issue 1 vol 4 ISSN: 2321-8134

IJFEAT

INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

EXTRACTION OF PECTIN FROM SWEET LEMON PEEL (MOSAMBI)

Pallavi T. Ghonge[1], Ankush D. Hedau[2], Neesha T. Sharma[3], Dr. Sanjay H. Amaley[4]

[1]*UG Student, Chemical Engineering, JDIET, Yavatmal, Maharashtra, India,**pallavighonge2@gmail.com***
[2]*UG student, Chemical Engineering, JDIET, Yavatmal, Maharashtra, India **ankush9004@gmail.com***
[3]*UG Student, Chemical Engineering, JDIET, Yavatmal, Maharashtra, India, nisha.sharma020@rediffmail.com*
[4]*Associate Professor, Chemical Engineering, JDIET, Yavatmal, Maharashtra, India**, sanjay_amaley@jdiet.ac.in***

Abstract

The aim of this work is to compare the characteristics of extracted pectin from two different maturity sources (sweet lemon peels of 100-110 days and sweet lemon peels of 60-65 days). Pectin is a mixture of complex polysaccharides, contains 1,4 - linked x and β galactosyluronic acid residues was extracted using alcohol precipitation method from peels of sweet lemon of different maturity, to obtain the pectin. The extraction was carried out under the parameters, like time, pH, & temperature (60min, 2.5, 80^0 C) and ethanol to filterate (sample) ratio is 1:1. The percentage yield by using citric acid was found for 60-65 days is 60.26% and for 100-110 days is 52.2% at same parameter. Pectin uses in pharmaceutical field.

***Keywords**: - Pectin, Yield, pH, Reagent, Time, Temperature, Waste utilization, Paracetamol*

---------- *** ----------

INTRODUCTION

Sweet lemon (Citrus sinensis) is citrus fruits that is most commonly grown tree fruit in the world. 'Mosambi' (sweet lemon), is one of the most important economical citrus fruits grown in central India with a total area of 41,018 has an annual production nearly of 0.4 million tonnes (Shinde and Kulkarni 2000). The two parts are easily differenttiated from each other with the pulp portion as the edible parts of the fruit while the peels as a good source of pectin (McGready, 1996). A precious items by-product that can be obtained from fruit wastes is pectin. There are a wide variety of citrus fruit vascular plant including oranges, lemons, limes, grapefruit, tangerines and pomelos, which are acidic and contain a healthy nutritional content. Around 70 % you look after the world's total citrus production is fully grown within the hemisphere, in particular countries around the Mediterranean and the United States although Brazil is additionally one amongst the most important citrus producers. World production of citrus fruits in the period 2009- 2010 was 123 million which includes grape fruit, lemons, limes, oranges, tangerines and other citrus fruits. India hierarchical fifth in citrus production (5 you look after worlds production) with half - dozen, 286,000. Citrus fruit is common because of its characteristic flavor, taste, aroma and multiple health benefits. Citrus fruits and products containing citrus are known for different health benefits and prevention of diseases in human (Fahad 2014). The medicative properties of citrus are associated primarily with antioxidant (ascorbic acid), which can be found in high concentrations in all types of citrus species.

Citrus peel represents 15–50 per cent of the total weight of fresh fruit. Citrus peel contains carbohydrates, proteins, minerals and fiber in significant amounts, making it an ideal stratum for production of valuable products. Fruit waste is the main source of municipal waste, which is nowadays goes on increasing and waste is creating more problems.The inexpensive and promptly accessible use of agro-food trade waste is very cost-efficient and minimizes environmental impact.The utilization of the fruit wastes as sources of bioactive compounds is also of the extended economic edges and has become more and more engaging. One of the most beneficial approaches is the extraction of bioactive compound, pectin.Pectins are high molecular weight complex polysaccharides (heteropolysaccharides) widely spread in the plant kingdom. They can be found as associate integral a part of the first plasma membrane and middle lamella of upper plants.

'Pectin' designates those cellulose substances soluble in water and capable of forming gels underneath appropriate conditions. Pectin varies considerably in composition and structure. Molecular weight can even vary with each biological science origin and maturity of the source. Pectin is employed as a jellying and thickening agent within the preparation of jams, jellies and marmalades, as a fat replacer in various food formulations and in the pharmaceutical industry for the treatment of diarrhoea, to reduce blood cholesterol levels and gastrointestinal disorders. It has conjointly been used as a surgical instrument agent. It is estimated that more than 50 per cent of the world's pectin production is in the making of jellies, jams, marmalades and confectionery products, where the ability of pectin to create gels is that the most vital property. Although the exact mechanism of gel formation is not clear, significant progress has been made in this direction.

In low- methoxyl cellulose, gelation results from ionic linkage via calcium bridges between two carboxyl

groups belonging to two different chains in belonging with each other. In high- methoxyl cellulose, the cross- linking of pectin molecules involves a combination of hydrogen bonds and hydrophobic interactions between the molecules. A number of factors—pH, presence of other solutes, molecular size, degree of methoxylation, number and arrangement of side chains, and charge density on the molecule - influence the gelation of pectin. Other applications of cellulose embody use in edible films, paper substitute, foams and plasticizers, etc.

In addition to pectolatic degradation, pectins are susceptible to heat degradation during processing, and the degradation is influenced by the nature of the ions and salts present in the system. The manufacture of cellulose is a fashionable and sophisticated method involving the preparation of raw materials as well as deactivation of enzymes, removal of bitter glycosides and crude sugars, conversion of protopectin into soluble cellulose, filtration of the extracted pectin, precipitation of the pectin, purification and drying of the pectin. There will be minor variations within the method as completely different fruit varieties vary in their cellulose content.It varies the current commercialy sourses of pectine are biproduct of mercadditionally at(deffernt totally comletly defferent) stages of matureness and thanks to different growing conditions fruit juice industry especially apple and citrus, there is more amount of of local fruits that are not consumed as well as waste materials from agricultural implementation and other fruit processing industries which can be used to produce pectin.

Pectin is wide utilized in the food business as a thickening, emulsifier, texturizer and stabilizer. It has additionally been used as a fat substitute in spreads, ice-cream and dish dressings. Pectin is found to lower blood cholesterol levels and low-density lipoprotein cholesterol fractions, which is beneficial for human health. According to the FAO (1969), pectin is considered to be a safe food additive that can be taken daily without limits. Pectin can be extracted through various methods. Usually, industrial cellulose is extracted associate exceedingly |in a very} multiple-stage physico-chemical method characterised by an extraction step with hot dilute mineral acid and recovery through alcohol precipitation. The present investigation was taken up to process, study the stabilization method, nutritional composition, extract and characterize pectin from peels of five different types of citrus fruits viz., 'Orange' (Citrus sinensis L.), 'Lemon' (citrus limon.), 'Lime' (Citrus aurantifolia L.), 'Pomelo' (Citrus maxima) and 'Sweet lime' (Citrus limetioides) grown in South. The highest concentrations of pectin are found in the middle lamella of cell wall, with some amount decrease as moving through the first wall toward the semipermeable membrane. Although cellulose present usually in most of the plant tissues, the number of sources that may be used for the commercial manufacture of pectin is limited. This is because; the flexibility of cellulose to create gel depends on the molecular size and degree of esterification (DE). Pectin gels are very important in creating or modifying the texture of jams, jellies, confectionary and in low fat dairy products. They are also used as ingredients in the pharmaceuticals industry and lower the glucose response. High methoxyl pectins gel in the presence of sugar gel but low methoxyl pectin gel in the presence of calcium. Gel strength depends on the length of molecule. At very low molecular weight, pectin is unable to form gels under condition. Although pectin commonly occurs in most of the plant tissues, the sources used for the commercial manufacture of pectin is limited. Citrus pectin are light cream to light tan in color whereas apple pectin are often darker. According to structure the pectin is an essentially to linear polysaccharide. Like most other plant polysaccharides, it is both polydisperse and polymolecular and its composition varies with the source and the conditions applied during isolation The composition and structure of pectin square measure still not fully understood though cellulose was discovered over two hundred years past. At present, cellulose is assumed to consist chiefly of Dgalacturonic acid (GalA) units6, joined in chains by means of α-(1-4) glycosidic linkage. These uronic acids have carboxyl teams, that square measure naturally gift as methyl group esters et al. that square measure commercially treated with ammonia to provide carboxamide teams.

MATERIALS AND METHODS

A) Sample collection:-

The mosambi was collected from the farm and then removed the outer cover of it (peeled) and washed it with water to remove the dust, dirt and residue of the pesticide spray. They were cutted into the small pieces ,then cook by dipped into boiling water for 5 min in inactive enzyme and later on filtered by hands through muslin cloth, after which insoluble material (pieces) were treated in warm absolute ethanol for 30 min to remove oil from peel and then washed. Pressed under pressure by hand to remove excess of water and pieces were dried at 60^0 C in tray drier until weight comes constant ,then grinded and stored in tight close container.

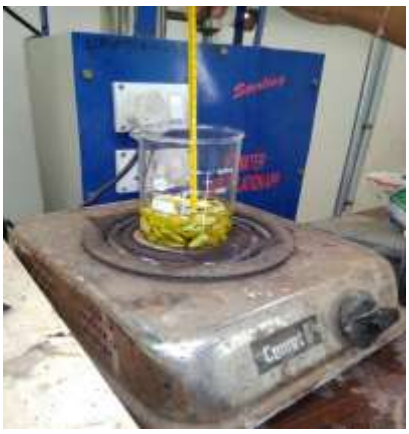

Fig-1: Warming of peels with ethanol at 60°c for 30 minutes.

B) Extraction of Pectin:-

The 5 kg of peel powder was weighted and transferred into 250 ml conical flask, and added 150 ml distilled water in it. For maintaining the pH the acid was added. For 2.5 ph medium, 14 gm (99.9%) acid required respectively. In the hot water bath the extraction procedure was done. The mixture was heated at different pH medium of extraction while stirred at 80^0 C at different time 60 min. The hot acid extract was separated (filtered) through muslin cloth.

Fig-2: Heating at 80^0C for 60 minutes.

C) Purification and Centrifugation Procedure:-

The aqueous extract containing pectin was coagulated by using an equal volume (1:1) of 99.1% ethanol at 4^0C and was left was for 3 hours. The precipitate formed was recovered by centrifugation and filteration, then washed with 50% ethanol and then with 70% ethanol.

Fig-3: Coagulated pectin after refrigeration.

Fig-4: Coagulation pectin strained after adding ethanol

D)Percentage yield of pectin:- The pectin yield was calculated using equation

% Yield of pectin =(e/Ii) x 100

where, e is the amount of extracted pectin in gm and Ii is the initial amount of orange or lime peel in gm.

EXPERIMENTAL SETUP

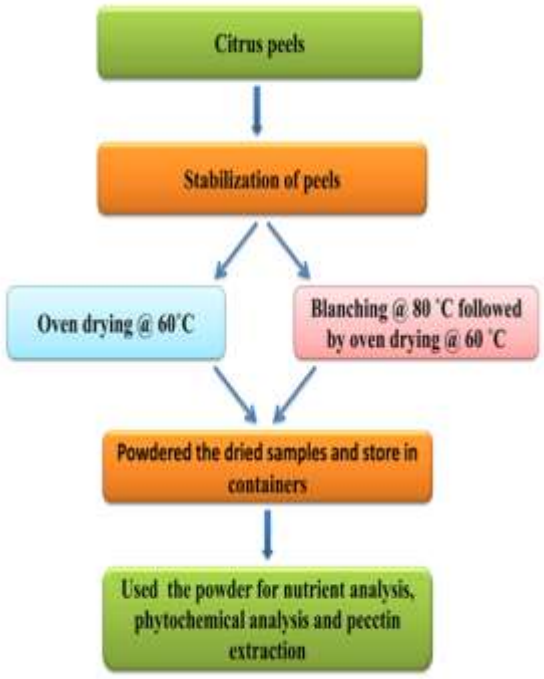

Fig- 5: Processing of Citrus peel sample

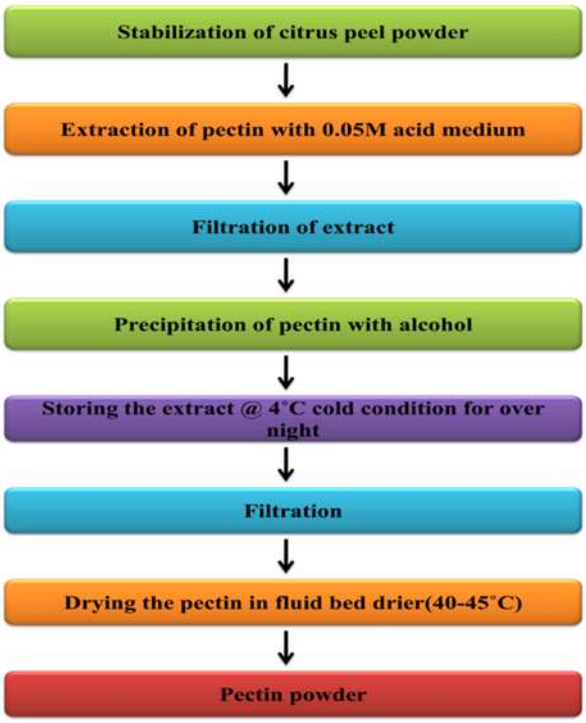

Fig-6: Extraction of pectin from citrus peel powder

Fig-7: (100-110 Days) Pectin Powder

RESULTS AND DISCUSSION:-

In this investigated the effect of temperature and acid condition on the extraction of pectin from fruit peel of citrus medicate color of it is important the pectin was dried by sun as light yellow[7]. Pectin is widely used as a texturizer, stabilizer, and emulsifier in a variety of food and other industries. Its used as a fat and sugar replacer in low calorie foods is expected to increase in their future with increasing demand for these foods. In spite of its availability in a large number of plants species, commercial sources of pectin are very limited. Gelation is the most important property of pectin that makes it an important component of food and pharmaceutical products. In our study we have worked on pH effect, temperature and time on isolation of pectin. We could find out the optimum parameter (pH, temperature, time) for different isolated pectin samples. The yield of pectin obtained is highest in muddy extract. The max overall yield of pectin is obtained from sweet lemon 60-65days[4]

Fig-8: (60-65 Days) Pectin Powder

Sr. No	Parameter	100-110 days peels	60-65 days peels
1	Color	Yellowish	White
2	Solubility in cold water	Slightly soluble	Slightly soluble
3	Solubility in hot water	The pectin suspension dissolved and turned milky.	The pectin suspension dissolved and turned milky.
4	Yield of pectin	52.2%	60.26%
5	pH	2.5	2.5

Table-1: Comparison of Pectin

Since all the values obtained experimentally were the percent yield of pectin 52.2% and 60.26% respectively. Conclusively, the peels of sweet lemon good sources of pectin which were extracted using alcohol precipitation.

CONCLUSION

This analysis and the characterization on pectin extraction from Sweet lemon (mosambi) peel, the research had been done on the basis of the yield % of pectin for 60-65 day and 100-110 days of sweet lemon peel. The results of extractants under the considered parameter like pH, temperature and time effect on the yield of extraction at the temperature at 80°C, 2.5 pH and for 60 min by using citric acid as the extracting solvent. This gave a percentage yield of pectin is 60.26% for 60-65 days and 52.2% for 100-110 days. From the results obtained, sweet lemon peel gives a significant amount of pectin as shown in above table.

ACKNOWLEDGEMENT

We are thanks to Head of Institute R.S.Tatwawadi, Head of Department A. P. Pardey, all the staff of chemical Engineering Department , for their financial, technical and academic support also ,one and all, who help us directly or indirectly to complete this academic assignment.

We also thanks to department of chemistry for their support and all the people who helped us directly and indirectly for the completion of this work, completion of this academic.

REFERENCES

[1] Elizabeth, W. Shukla, R. N. Bala, K. L. Kumar, A. And Mishra, "Extraction of pectin from citrus fruit peel and its utilization in preparation of jelly, IJERT" 3 (5),pg 1-8,(2014).

[2] Aina, V. O. Barau, M. M. Mamman, O. A. Zakari, A. Haruna, H.Umar, M. S. And Abba, "Extraction and characterization of pectin from peels of lemon (Citrus lemon), grape fruit. (Citrus paradise) and sweet orange (Citrus sinensis), British J Pharmacol Toxicol", 3(6): pg 259-262, (1982).

[3] Kliemann, E. Simas, N. K. Amante, R. E. Prudencio, S. E. Filo, R. T. Ferreira, M. C. And Amboni, "Optimisation of pectic acid extraction from passion fruit peel (Passiflora edulis flavicarpa) using response surface methodology. International J. Food Sci. Technol" 44: pg 476-483,(1991).

[4] Rehman, Z. U. And Salariya, "Comparative aspects of pectin extraction from peels of different varieties of citrus fruit. Pakistan J. Food Sci", 15(12): pg 21-23, (2004) .

[5] Sudhakar, D. V. And Maini, "Isolation and characterization of mango peel pectins. J. Food sci", 24: pg 209-227,(2007).

[6] Thakur, B. R. Singh, R. K., Handa, V. K. And Rao, "Chemistry and uses of pectin. A Review. Critical Reviews in Food Science and Nutrition", 37(1):pg 47-73,(1997).

[7] Schemin, C. M, Fertonani, C. H, Waszczynskyj, N.And Wosiacki, "Extraction of pectin from apple pomace. J. Bio. Technol", 48 (2): pg 259-266, (2005).

[8] McGready, R.M, "Extraction of Pectin from Citrus Peels and Conversion of Pectin Acid. 2nd Edn., Academic Press, New York", 4:pg 167-170, (1996).

[9] Kertesz ZI, "The Pectic Substances, New York Interscience", pg 41, (1951).