Extraction of Pectin from Kinnow (Citrus) Peel

Laxmi Deepak Bhatlu M[1], Satya Vir Singh[2]
[1,2]*Department of Chemical Engineering & Technology*
Indian Institute of Technology (BHU), Varanasi, Varanasi-221005, U.P, India

ABSTRACT

Kinnow peel (Citrus reticulata) is a major waste generated during processing of kinnow fruit which can be used to make pectin. Pectins were extracted from dry kinnow peels in the presence of water by adjusting its pH with HCl. The extracted pectin is then precipitated by adding ethanol. The precipitated pectin is then filtered off from alcohol water mixture and purified by repeated washing with ethanol and dried at low temperature under vacuum and then quickly ground. Pectin has obtained with 40% of purity and recovery of crude pectin was found to be 61%.

Keywords: Pectin, Extraction, HCl, Ethanol

1. INTRODUCTION

The food industries generate significant quantities of biodegradable waste material during processing of fruits into various products. At present the fruit processing industries dispose the waste thus generated without any treatment in the nearby low-lying areas resulting in pollution of the environment. The peels etc are also used as animal feed but peels of some of the fruits are not consumed by animals. Peels in a small amount are used as fuel along with dung cake in developing countries like India. The extraction of pectin from peels etc can be a valuable addition to fruit processing industries. The main advantage for the production of pectin from peels etc is the utilization of waste.

Kinnow (*Citrus reticulata*), a hybrid of King & Willow leaf, is a variety of citrus fruit. In the processing of kinnow fruit yields 50 percent juice, 25 percent peel, 23 percent residue and 2 percent seeds. A major portion of the fruit is going waste during processing, which can be utilized for many value added products. On an average, kinnow peel contains 22.45 percent total solids, 12.500 B TSS, 1.38 percent acidity, 41.57 mg/100g ascorbic acid, 6.23 percent total sugars, 5.99 percent reducing sugars, 0.67 percent ash, 13.65 mg/100g carotenoids, 7.43 mg/100g β-carotene, 1.85 percent pectin & 0.77 percent fat. It also contains naringin (0.420 mg/g, approx) and limonin (4.69 mg/g approx) [7].

Pectin is a diverse group of acidic polysaccharides, found in primary cell wall and the intercellular regions of plants, usually called as "nature's glue". Most pectins are composed of D-galacturonic acid unit (a linear galacturonglycan of α-(1-4)-linked D-galactopyranosyl-uronic acid units), which is present in α-(1-4)-linked linear chain in which varying proportions of acid groups are esterified with methanol. It is used in the manufacturing of many fruit products like jams, jellies, marmalades, preservatives, glazes, milk gels, desserts etc. It has an important role in shaping of such products. It also finds uses as a thickening agent in sauces, ketchups, flavored syrups and as a Texturing agent in fruit flavored milk desserts [10].

Most of the commercial pectin is extracted from citrus peels and apple pomace (in which pectin content ranges from 20 to 40 g/100 g on dry weight basis [9]) at high temperatures by hydrolyzing protopectin using acids such as sulfuric, phosphoric, nitric, and hydrochloric or citric acid [10]. Cho and Hwang, (2000), Canteri-Schemin et al., (2005), Garna et al., (2007) extracted pectin from apple pomace using conventional method of heating. Wang et al., (2007) applied microwave-assisted extraction for the pectin extraction from dried apple pomace. Jie et al. (2009) used microwave-assisted extraction of pectin from orange peel. Zhao-hui et al. (2011) optimized the conditions for pectin extraction from orange peels. Koubala et al. (2008), Kai et al. (2010), Fishman et al. (2006), extracted pectin from lime peel. Singh and Dhillon, (2007) extracted pectin from dried kinnow peels using 0.05 N hydrochloric acid at 90°C. Keeping in the view of pectin uses and waste disposal problem of peels, extraction of pectin from peels is essential. The aim of this study was to extract the pectin from kinnow peels.

2. MATERIALS AND METHODS

2.1 Chemicals

Galacturonic acid purchased from **Sigma Aldrich** chemicals, Ethanol (C_2H_5OH), Hydrochloric acid (HCl), H_2SO_4, 0.1% Carbazole reagent were purchased from **Merck** specialties Pvt. Limited, Sodium hydroxide (NaOH) purchased from **Qlualigens** fine Chemicals Limited, Distilled water was used for preparing all the solutions.

2.2 Sample preparation

Kinnow fruits were obtained from local fruit vendors in Varanasi, India. The peels were removed, finely cutted and dried in a hot air oven at 60°C until it attains constant weight. The dry peels were used in the experiments.

2.3 Extraction of pectin

In this method, pectin extraction from raw material (500 g) is carried out by boiling the material in water for 1 hr and pH 2.2 was adjusted with HCl. The contents were cooled to room temparature

and centrifuged at 5000 rpm for 35 min. The pH of the solution was adjusted to 7 with 4N NaOH. The extracted pectin is then precipitated by adding ethanol. The precipitated pectin is then filtered off from alcohol water mixture and purified by repeated washing with acidified alcohol and dried at low temperature under vacuum and then quickly ground. The pectin extraction process has been shown in figure 1.

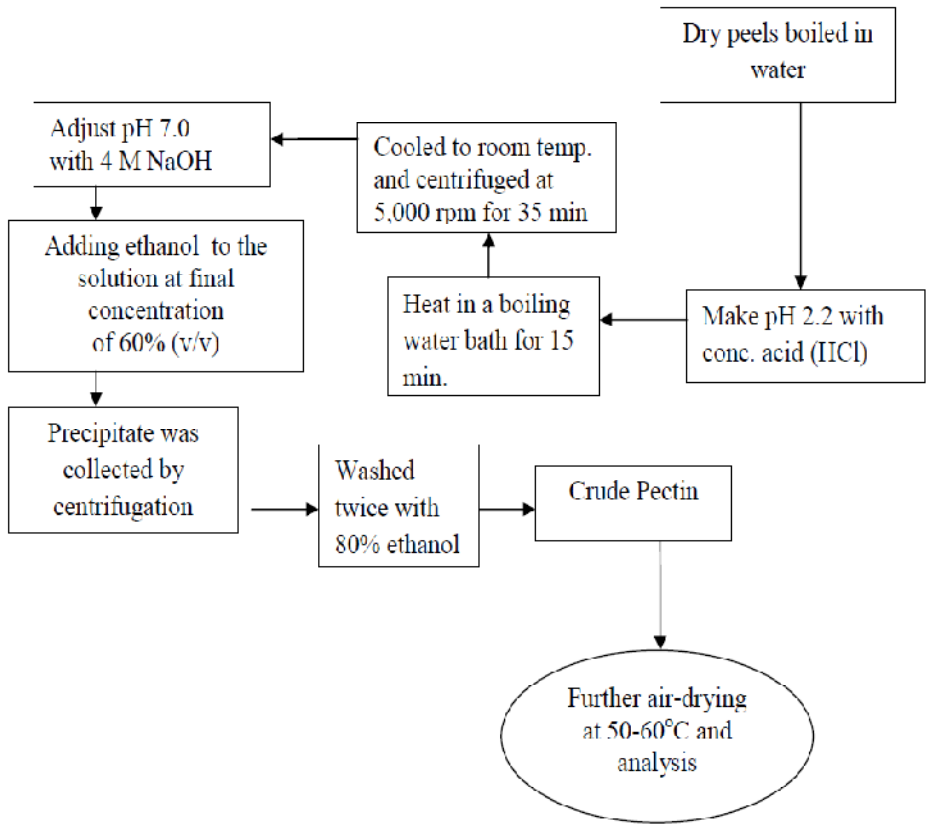

Figure 1: Pectin Extraction Process

2.4 Analysis of pectin

Colorimetric Method (Ranganna, 2005) was used to determine the pectin content of the product. The colorimetric method is based on the reaction of galacturonic acid, the basic structural unit of pectin molecule, with carbazole in the presence of H_2SO_4 and measurement of the color at 525 nm. Depending upon the standard used, the results may be expressed as anhydrogalacturonic acid (AuA), pectic acid, or in terms of a stated pectin or calcium pectate. However, it is desirable to present the result as AuA, since it is the basic structural unit of pectin.

3. RESULTS AND CONCLUSIONS

After recovery of pectin, 150 mg of raw pectin (wet basis) was dissolved in 100ml of distill water. Its concentration was 0.40 kg/m^3. Therefore pectin present in the solution was 0.40 g and purity of pectin was 40%. Its purity was low, becouse of the pectin obtained from kinnow peels may contain colur pigments, fatty acids and citric acid etc. its studies for further purification are required. The recovery of crude pectin was found 61%. Several materials have been investigated for the extraction of pectin however, apple pomace and citrus peels are the main raw materials used commercially. A Kinnow peel contains 1.85 percent pectin. This is suitable for extraction of pectin.

REFERENCES

[1] Canteri-Schemin, M. H., Fertonani, H.C.R., Waszczynskyj, N., & Wosiacki, G. (2005). Extraction of Pectin from Apple Pomace, Brazilian Archives Biology and Technology, 48(2), 259-266.

[2] Cho, Y.J., & Hwang, J.K. (2000). Modeling the yield and intrinsic viscosity of pectin in acidic solubilization of apple pomace, Journal of Food Engineering, 44(2), 85-89.

[3] Fishman, M.L., Chau, H.K. Hoagland, P.D., & Hotchkiss, A.T., (2006).Microwave-assisted extraction of lime pectin, Food Hydrocolloids, 20(8), 1170-1177.

[4] Garna, H., Mabon, N., Robert, C., Cornet, C., NOTT, K., Legors, H., Athelet, B., & Paquot, A. (2007). Effect of Extraction Conditions on the Yield and Purity of Apple Pomace Pectin Precipitated but Not Washed by Alcohol, Journal of Food Science, 72(1), 1-9.

[5] Jie, ZHENG., Ting, YANG., Qiang, WU., Jing, LI., & Ya-na, WANG. (2009). Microwave-assisted Extraction of Pectin from Orange Peel, Food Science, 30 (20), 134-137.

[6] Kai, Z., Guo-lin, H., Zhong-sheng, C., De-juan, H., & Na-na. (2010). Microwave-assisted Extraction Kinetics and Thermodynamics of Pectin from Lemon Peel, China Food Science, 31(15), 107-111.

[7] Kaur, K. S., & Poonam Aggarwal, S. (2013). Development of Phytochemical Rich Ice Cream Incorporating Kinnow Peel. Global Journal of Science Frontier Research, 13(4).

[8] Koubala, B.B., Kansci, G., Mbome, L.I., Crepeau, M-J., Thibault, J-F., & Ralet, M-C. (2008b). Effect of extraction conditions on some physicochemical characteristics of pectins from ‘‘Amelioree’’ and ‘‘Mango’’ mango peels, Food Hydrocolloids, 22, 1345-1351.

[9] Kulkarni, S.G., & Vijayanand, P. (2010). Effect of extraction conditions on the quality characteristics of pectin from passion fruit peel (Passiflora edulis f. Flavicarpa L.), LWT - Food Science and Technology, 43, 1026-1031.

[10] May, C.D. (1990). Industrial Pectins: Sources, Production and Applications, Carbohydrate Polymers, 12, 79-99.

[11] Ranganna, S., (2005). Handbook of analysis and quality control for fruit and vegetable products 2nd edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 42-43.

[12] Singh, M., & Dhillon, S.S. (2007). Extraction of pectin from kinnow peels, International Journal of Environmental Studies, 64(3), 287.

[13] Wang, S., Chen, F., Wu, J., Wang, Z., Liao, X., & Hu, X. (2007). Optimization of pectin extraction assisted by microwave from apple pomace using response surface methodology, Journal of Food Engineering, 78, 693-700.

[14] Zhao-hui, X., Xin, Z., Zhi-jun, Z., Jian-hua, L., Yi-fan, W., Dong-xu, C., & Li-sheng, L. (2011). Optimization of Pectin Extraction from Citrus Peel by Response Surface Methodology, Food Science, 32(18), 128-132.