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A REVIEW: DIFFERENT EXTRACTION TECHNIQUES OF PECTIN

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Abstract

An pectin, a by product of citrus peels from orange is the basic aim of these study. The outcome of the present work focus that the sweet orange peels are good source of orange oil and pectin and does have the potential to become essential raw material for food processing industries. India is one of the major production country of orange is about 2.64 millions/year. In Maharashtra specially in Nagpur region is well known in central Asia to produce and market for orange. It is also well known as the California of India, producing excellent quality of oranges in large number. The present work addresses to the development of the part of the process needed for the extraction of value added product like pectin from orange peel, which is the waste of orange juice processing industry. Pectin which carry 1, 4-linked x and β galactosyluronic acid residues was extracted using alcohol precipitation method from citrus peels of lemon and sweet orange. In food industry pectin is recently investigated for different applications, medicinal and pharmaceutical field. Two methods such as simple distillation & leaching have been explored for separation of oil from peels. Orange oil is first extracted using methods of simple distillation followed by acid extraction of pectin is most suitable for industrial preparation of isolation of pectin. The pectin yields for the centrifugation and cheesecloth (Cotton cloth) methods were 14.3% and 10.6%, respectively. These results indicated that more pectin was retained using the centrifugation method[42].

Index Terms: *Pectin, Orange Peels, Extraction, Applications.*

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1. INTRODUCTION

Pectin has been recognised for at least 127 years back and was originally identified in 1790 in apples by the French chemist Nicholas Vauquel in. It was not until 1824 that further work on pectin was carried out by Bra connot who named the acid, gelling substance pectic acid after the Greek word for gelling or congealing. In the 1920s and1930s, pectin was first extracted from dried apple pomace. In 1924 Smolenski identified the gelling substance as a polymer of galacturonic acid and later on in the 1937 Schneider and Bock established the basic formula of pectin[1-3]. Pectin (derived from Greek meaning congealed and curdled‖) is a structural hetero-polysaccharide contained in the primary cell walls of terrestrial plants[4]. There is a wide range in production of oranges in tropical and subtropical climates for the sweet fruit, which is peeled or cut and eaten or processed to extract orange juice, and also for the fragrant peel[5].

Pectin is mainly used in the food industry as a gelling agent and is the key gelling agent in jam manufacture which is still one of the largest market for pectin. Few years ago, Pectin sold as a liquid extract, but is now most often used as dried powder, which is easier than a liquid to store and handle. Pectin is a naturally occurring biopolymer that is finding increasing applications in the pharmaceutical and bio technology industry[6-7].

New application opportunities have emerged and pectin is no longer just a gelling agent but also used in wide applications [8]. Pectin also has several unique properties that have enabled it to be used as a matrix for the delivery of a variety of drugs, proteins and cells[9]. Pectin is polysaccharides mixture that makes up about one third of the cell wall dry substance of higher plants. The number of sources that may be used for the commercial manufacture of pectins is very limited[10].Citrus pectins are light cream or light tan in colour; apple pectins are often darker.

2. EXTRACTION TECHNIQUES OF PECTIN

2.1 Acid Extraction of Pectin

Pectin has been extracted using chemical methods in order to study the structural features as well as functional properties of pectin. For pectin extraction chemical agents used are divided into four groups. They are water and buffers, calcium-ion chelators, acids and bases. the strongest extracting agents of pectin are acids as they facilitate extraction of insoluble pectin that is closely bound to the cell matrix of the plant material and result in higher yields [11-13]. Pectin is generally enriched in galacturonic acid. Various studies have shown the effects of acid extractant strength on yield of pectin, chemical, and/or physicochemical characteristics [14]. Most commonly used acids are acetic, citric, lactic, malic, tartaric (organic), hydrochloric, nitric, oxalic, phosphoric and sulfuric acids [15-17]. Hydrochloric acid (HCL) shown to be the highest yield of pectin among hydrochloric (HCL), nitric acid (HNO_3) and citric acid extracted from guava peel, citrus fruits, banana and cocoa pods. pH and temperature ranged from 1 to 3and 60°C to 85°C sequently [18-21]. Presence of high concentration of hydrogen ions, stimulate the pectin hydrolysis from proto pectin. Higher ionic strength acids have an improved capability to precipitate pectin due to their higher affinity for cations such as calcium ions which stables the pectin molecule. However, hydrochloric acid produced pectin with a smaller DM range in which LM pectin [22]. In hot acid media pectin can be degraded rapidly due to high lability and sensitivity for acid. So, Pectin extracted using hot acid is low methoxylated because of demethylation and fragmentation of the poly galacturonic chain. Moreover, LM pectin occurs in a broad pH range, at most up to pH 6 [23-26]. In order to extract pectin Nitric acid is also commonly used to acidify hot water.

2.2 Enzymatic extraction

Plant cell wall is composed of an trapped network of different polysaccharides including pectin. Cell wall degrading enzymes with minimum pectinolytic activity are used to hydrolyzen on pectin plant cell wall components in enzymatic extraction of pectin [27,28]. Enzymatic extraction of pectin is environmentally safe and pectin yield is more efficient. Various types of enzymes like polygalacturonase, hemicellulose, protease and microbial mixed enzymes, cellulose, α-amylase, celluclast, alcalase , α-amylase, neutrase, Xylase, cellulose, b-glucosidase, endo polygalacturonase and pectin esterase are mainly used in pectin extraction as an enzymes have the ability to humiliate the pectin and alter the physicochemical properties of the pectin [29-37].

2.3 Microwave extraction of pectin

When orange peels are subjected to microwave radiation, there is inactivation of pectin esterase enzyme and destruction of orange skin cells due to rapid heat generation in microwave environment [38].Since the pectin esterase interacts with the pectic substances in the orange peels and reduces their solubility, their inactivation improves the pectin extraction. Pectin yield increases when microwave power increases, pactin yield has been increased due to the increase in microwave irradiation energy, the penetration of solvent into the plant matrix can be enhanced and can efficiently provided to plant cells for pectin extraction.

3. ANALYSIS

3.1 Solubility in hot and cold water (dry pectin):

Initially, 0.03g of the pectin samples were taken in different conical flasks with 10 ml of 95% ethanol added followed by 50 ml distilled water. The mixture obtained was oscillate vigorously and suspension was formed which was then heated at 85-95°C for 15 min using magnetic stirrer.

3.2 Solubility in hot and cold alkali (NaOH):

Initially, 10 ml of 0.1N NaOH taken in a conical flask, 0.1g of dry pectin was added and was heated at 85-90 °C for 10- 15 minutes using magnetic stirrer.

Table-1: The Characterized Parameters for the Two Samples by Using Acetone.[40]

S. No	(%)	Lemon	Orange
1	Percentage yield of pectin in dry basis	0.8	0.2
2	Percentage yield of pectin in wet basis	8	6
3	Equivalent weight (mg/mol)	100	86.87
4	Methoxyl content	4.230	5.321
5	Moisture content	66.60	95.25
6	Ash content	30.00	35.00
7	pH	3.9	4.5

Table-2; High Percentage Sources [1% and above] [41]

1	Beet pulp [Beta vulgaris)	1
2	Apple pomace	1.5-2.5
3	Tamarind [Tamarindus indica L.]	1.71
4	Passion fruit rind	2.1-3.0
5	Lemon pulp [Citrus limon]	2.5-4.0
6	Orange peel [C. Sinesis]	3.5-5.5

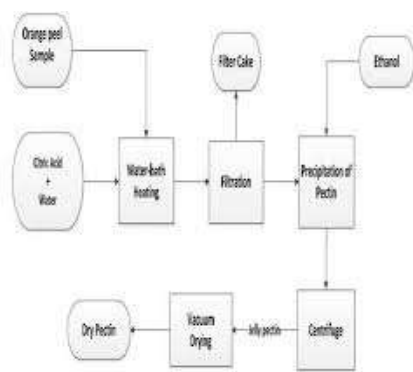

Fig-1: Process flow chart for extraction of pectin from Orange Peel Sample. [39]

3. Effects of processing factors on pectin yield

The yield of pectin ranged from 12.93–29.05% (Table 3). This compares approving with the findings of other researchers on pectin yield from orange peels. El-Nawawi and Shehata (1987) and Marin et al. (2007) obtained pectin yield ranging from 21–30 and 13–23%, respectively, while Hashmi et al. (2012), Kanmani et al. (2014), Dehankar et al. (2015), and Khan et al. (2015) described maximum pectin yields of 20.12, 29.41, 20, and 21%, respectively. These differences could have been due to the nature of the fruits and extraction process and the processing conditions[43].

Table- 3; Pectin yield at various processing conditions [43]

Run	Temperature (℃)	Time (Min)	pH	Pectin Yield (%)
1	90.00	90.00	2.00	19.12
2	90.00	90.00	2.00	19.90
3	95.00	105.00	1.50	29.05
4	90.00	90.00	1.00	27.77
5	85.00	75.00	2.50	14.53
6	80.00	90.00	2.00	13.36
7	90.00	90.00	2.00	18.83
8	90.00	90.00	2.00	18.07
9	90.00	90.00	2.00	18.69
10	95.00	75.00	2.50	14.85
11	85.00	75.00	1.50	15.70
12	90.00	90.00	2.00	19.64
13	90.00	60.00	2.00	13.55
14	85.00	105.00	1.50	24.49
15	90.00	90.00	3.00	12.93
16	95.00	105.00	2.50	23.56
17	85.00	105.00	2.50	16.05
18	95.00	75.00	1.50	16.05
19	100.00	90.00	2.00	26.83
20	90.00	120.00	2.00	25.55

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