Journal of Experimental Food Chemistry

Hamed et al., J Exp Food Chem 2017, 3:1
DOI: 10.4172/2472-0542.1000122

Research Article Open Access

Effect of Soxhlet Method Extraction on Characterization of Pectin of Pumpkin Peels

Awadia Aldow Ramadan Hamed[1*], Abdeen Elsiddig Eltyeb Elkhedir[1] and Salma Elghali Mustafa[2]

[1]*Food Industry Department, Industrial Research and Consultancy Center (IRCC), Khartoum, Sudan*

[2]*Department of Food Science and Technology, Faculty of Agricultural Studies, Sudan University of Science and Sechnology, Khartoum, Sudan*

[*]**Corresponding author:** Awadia Aldow Ramadan Hamed, Food Industry Department, Industrial Research and Consultancy Center (IRCC), Khartoum, Sudan, Tel: 0024991249010; E-mail: abdeensiddig@yahoo.com

Received date: December 08, 2016; **Accepted date:** January 27, 2017; **Published date:** February 03, 2017

Abstract

With the present study was focused on the potential of pumpkin peel as a source of pectin, it was aim to determine a pratical follow-up to the extraction of pectin from pumpkin peels Extraction (*Cucurbita* spp.) using soxhlet with two different acids. Moreover to investigate the influence of time on pectin yield and to characterize the output, determinations were performed of methoxyl content, acetyl content, equivalent weight and degree of esterification in a laboratory, on a small scale. The result showed higher average yield of pectin obtained by using soxhlet acid extraction (7.72% for nitric acid and 6.80% for citric acid), while the lower yield were obtained with acid extraction without using soxhlet (6.24% for nitric acid and 5.36% for citric acid). Equivalent weight and acetyl contain of extracted pectin with both nitric and citric acids were (1250 g/mol and 0.43) respectively, while methoxyl content was (6.20% and 7.23 %), the degree of esterification was (66.53% and 66.57%) for nitric and citric acid respectively. The results showed that pumpkin peels are a promising commercial source of pectin.

Keywords: Pumpkin peels; Extraction; Pectin

Introduction

Pumpkin (*Cucurbita maxima*) belongs to the family Cucurbitaceae, is an excellent resource of carotenoids, precursors of vitamin A, and has been regarded as a functional food [1,2]. It is also a low cost source of pectin [3]. Pumpkin peels, which are produced during processing and discarded as agricultural by-products, are rich in pectin. Accordingly, information about the yield, structure and properties of pectin from pumpkin peels could be of importance from both industrial and scientific points of view. Pectic substances in fruits were discovered by the French chemist Louis Nicolas Vauquelin in tamarind fruit. The term "pectin" was introduced by Henri Braconnot due to the gelling properties of these substances [4,5]. Pectins are structural polysaccharides present within all dicotyledonous plant cell walls. The primary structural feature of pectin is a linear 1,4-α linked D-Galacturonic acid chain with varying degrees of methylation, which are responsible for different physiological processes [6]. In the cell walls they serve as one of the main agents cementing the cellulose fibrils and may be linked covalently to other polymers. Intracellular pectins provide the channels for passage of nutrients and water [7]. The main raw materials used to produce commercial pectin are apple pomace and citrus peel [6] sugar beet and sunflower heads [7]. Several studies on the extraction methods of pumpkin pectin have been performed using different extraction methods, such as an acidic extraction method and enzymatic extraction method [8,9]. Commercial pectins are extracted at low pH and high temperature. Pectins are widely used as food additives (E440) with gelling and stabilizing properties in jams, jellies, marmalades, milks and confectionery products [10]. The study is aimed to determine the proximate composition of pumpkin peels (moisture, crude protein, ash, fat, crude fiber and carbohydrate), to examine the influence of soxhlet method extraction with different acids (nitric and citric acids) on pectin obtained and to characterize the obtained pectin.

Materials and Methodology

Materials

Mature pumpkin was purchased from local market, Khartoum North; the peel was separated from the flesh, dried, and the rind was ground to uniform size using a food processor at high speed.

Methods

The proximate analysis of pumpkin peels (Moisture, Ash, Protein, Fats, Fiber content and Carbohydrate content) were performed according to the methods described by [11].

The soxhlet acid extraction of pectin was carried out using the method of [12], the acid extraction was carried out as suggested by [13]. Moisture and ash content were determined depending on the method of [12].

Equivalent weight and Methoxyl Content, Acetyl content and the Degree of esterification (DE) were determined according to the methods of [14].

Statistical analysis

All statistical analyses were performed using SAS version 9.1 (SAS Institute Inc., Cary, NC, USA). Analysis of variance (ANOVA) was performed using the general linear models (GLM) procedure to determine significant differences among the samples. Means were compared by using Fisher's least significant difference (LSD) procedure. Significance was defined at the 5% level.

Results and Discussion

The proximate analysis of pumpkin peels:

The result of the proximate analysis of pumpkin peels were showed in Table 1 expressed on a dry basis.

The moisture, ash, protein, fiber, fat and carbohydrates were 20.1, 7.1, and 3.2, 10.15, 2.3 and 57.15% respectively.

Parameter	Content (%)
Moisture	20.1
Ash	7.1
Protein	3.2
Fiber	10. 2
Fats	2.3
Carbohydrate	57. 2

Table 1: Proximate analysis of pumpkin peels on dray basis.

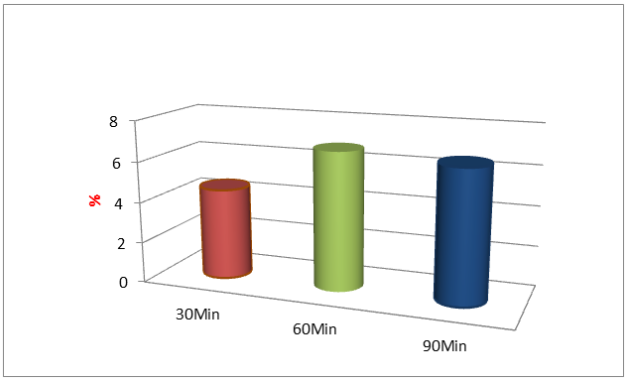

Figure 1: Effect of time of extraction on the yield of pumpkin peels pectin.

The results in Figure 1 revealed that the yields of pectin using soxhlet acid extraction method were 7.72% and 6.80% for nitric and citric acid, respectively, while acid extraction without using soxhlet showed lower value (6.24%) for nitric and (5.36%) for citric acid respectively. The results were also supported by other researcher who concluded the amount of pectin extracted from pumpkin peel 253-0.233 % obtained using Alcohol insoluble by Hamed [15].

The effects of extraction time on pectin yield were shown in Figure 2. There was increasing on pectin yield from 30 to 60 min in pectin extraction times.

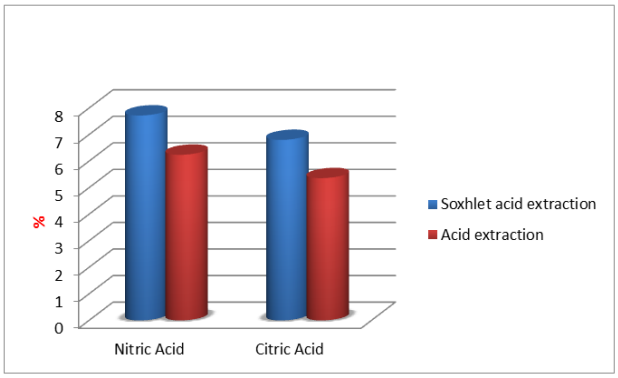

Figure 2: Effect of extraction methods on pumpkin peels pectin yield (%).

The moisture content of pectin from pumpkin peels was 5.54% using nitric and 5.42% using citric acids as shown in Table 2. Significantly different from each other at $p \leq 0.05$; It was 7.88-8.96% in grapefruit peels pectin [14]. 5.03-5.04 % as in mango pulp pectin as reported by [16].

3.17 for pectin obtained from pumpkin peel's using nitric acid and 2.96% using citric acids as Table 2, lemonorange and apple 1.65%-1.56 , 0.49-0.81% and 0.49-8.05%, respectively [15,16].

Parameter	Pectin extracted by nitric acid (%)	Pectin extracted by citric acid (%)	Level of significance (P-value)(%)
Moisture content	5.45 (± 0.01)	5.42 (± 0.01)	0.0^{**}
Ash content	3.17 (± 0.006)	2.96 (± 0.006)	0.0011^{*}
Acetyl	0.43 (± 0.01)	0.43 (± 0.03)	$1.0^{n.s}$
Methoxyle	6.2 (± 0.10)	7.23 (± 0.89)	$0.2102^{n.s}$
Equivalent weight	1250 (± 0.0)	1250 (± 0.0)	$1.0^{n.s}$
Degree of esterification	66.53 (± 0.058)	66.57 (± 0.058)	$0.6667^{n.s}$
Values are mean ± SD; n.s: Not Significant; *= significant ($P \leq 0.05$); **= highly significant ($P \leq 0.01$)			

Table 2: Characterization of pumpkin peel pectin.

1250 g/molas (Table 2), cocoa husk pectin it was 510.68-645.19 g/mol Ramli [17] and lower than the range of 1389-2003, 833.33-1666.30 and 263,000-303,000 g/mol for mango pulp, apple pomace and ambarella peels [16,18].

The methoxyl contents of pumpkin peel pectin were 6.20% using nitric acid and 7.23% using citric acids, as shown in Table 2. No significant differences at $p \leq 0.05$ were observed between the two samples. This was lower than lemon pomace, which was 10.25%, pomelo peel 8.57%, Lime 9.92% and passion 8.81-9.61% [19,20], but it was similar in mango peels pectin 7.33%, banana peels pectin 7.03% [20]. Methoxyl content is an important factor in controlling the setting time of pectin and the ability of the pectin to form gels [16].

The acetyl content of pumpkin peel pectin was 0.43 for both nitric and citric acids. The results were confirmed by other researchers who found 0.46-1.63% in grapefruit peel pectin whereas it was higher than 0.117% to 0.314%, recorded in mango pulp pectin [15,21]. The acetyl contain of pectin has the important role on the jelly formatting ability [21].

The degree of esterification of pectin pumpkin peel's was showed in table 2, 66.53% for nitric acid and 66.57% with citric acids. These results are similar to the values 66.9% reported for mango peel pectin but higher than 51.01-51.24% obtained for grapefruit peel pectin [15,22,23]. They are lower than the values 73.9, 87.0 and 79.51% reported for pumpkin pectin, mango pulp pectin and lemon pomace pectin respectively [21,22,24].

References

1. Arima HK, Rodriguez-Amaya DB (1990) Carotenoid composition and vitamin A value of a squash and a pumpkin from north eastern Brazil. Archivos Latino americanos de Nutrición, 40, 284.
2. Adams GG, Imran S, Wang S, Mohammad A, Kok MS, et al. (2012) Extraction, isolation and characterisation of oil bodies from pumpkin seeds for therapeutic use. Food Chemistry 134: 1919-1925.
3. Mülleder M, Neunteufl H (2002) Carotenoid content in different varieties of pumpkins. J Food Compost Anal 15: 633-638.
4. Georgiev Y, Ognyanov M, Yanakieva I, Kussovski V, Kratchanova M (2012) Isolation, characterization and modification of citrus pectins. J Bio Sci Biotech 1: 223-233.
5. Devi EW, Shukla RN, Abraham A, Jarpula S, Kaushik U (2014) Optimized extraction condition and characterization of pectin from orange peel. IJREAT 2: 1-10.
6. Wang YC, Chuang YC, Hsu HW (2008) The flavonoids carotenoid and pectin content in peels of citrus cultivated in Taiwan. Food Chem 106: 277-284.
7. Kertesz ZI (1951) The pectin substances. Interscience, New York, USA, p. 438.
8. Fissore EN, Ponce NM, Stortz CA, Rojas AM, Gerschenson LN (2007) Characterisation of fiber obtained from pumpkin (cucumis moschata duch) mesocarp through enzymatic treatment. Food Sci Tech Int 13: 141-151.
9. Ptichkina NM, Markina OA, Rumyantseva GN (2008) Pectin extraction from pumpkin with the aid of microbial enzymes. Food Hydrocolloids 22: 192-195.
10. Sakai T, Sakamato T, Hallaert J, Vandamme EJ (1993) Pectin, pectinase, and protopectinase: production, properties, and applications. Adv Appl Microbiol 39: 213-294.
11. Horwitz W, Chichilo P, Reynolds H (1970) Official methods of analysis of the Association of Official Analytical Chemists. Washington, AOAC 11: 1015.
12. Malviya R, Srivastava P, Bansal M, Sharma PK (2010) Mango Peel Pectin as natural polymer Agents. J Sci Ind Res 69: 688-690.
13. Crandall P, Braddock R, Rouse A (1978) Determining the yield and quality of pectin from fresh peel and pectin pomace. Proc Fla State Hort Soc 91: 109-111.
14. Owens H (1952) Methods used at Western Regional Research Laboratory for extraction and analysis of pectic materials. Albany, CA 340: 33.
15. Hamed AAR (2015) Extraction and Assessment of pectin form Pumpkin Peels, Sudan University of Sciences and Technology.
16. Constenla D, Lozano J (2003) Kinetic model of pectin demethylation. Latin American applied research 33: 91-96.
17. Ramli N (2011) Effect of ammonium oxalate and acetic acid at several extraction time and pH on some physicochemical properties of pectin from cocoa husks (Theobroma cacao). Afr J Food Sci 5: 790-798.
18. Kumar A, Chauhan GS (2010) Extraction and characterization of pectin from apple pomace and its evaluation as lipase (steapsin) inhibitor. Carbohydrate Polymers 82: 454-459.
19. Azad A, Ali M, Akter MS, Rahman MJ, Ahmed M (2014) Isolation and characterization of pectin extracted from lemon pomace during ripening. J Food Nutr Sci 2: 30-35.
20. Madhav A, Pushpalatha P (2002) Characterization of pectin extracted from different fruit wastes. J Tropical Agriculture 40: 53-55.
21. Abdel-Rahman N (2002) Characterization of pectic substances of abu-samaka cultivar in relation to their influence on mango pulp concentrate.
22. El Tinay A, El-shafie A, Nour A (1982) A chemical study of pumpkin pectic substances. Dep of Bio, Faculty of Agriculture, University of Khartoum, Sudan.
23. Koubala B, Mbome L, Kansci G, Mbiapo FT, Crepeau MJ, et al. (2008) Physicochemical properties of pectins from ambarella peels (Spondias cytherea) obtained using different extraction conditions. Food Chemistry 106: 1202-1207.