Study of Optimal Condition for Extraction of Pectin from Okra and its application

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Abstract

This research project aimed to study the optimal conditions for pectin extraction from Okra, *Abelmochuses-culentus (L.)Moench*. The important physical and chemical properties of extracted pectin were also studied. The appropriate extraction parameters including acid type, concentration, temperature, extraction time, and percentage of sodium hexametaphosphate (%SHMP) were investigated. The optimal extraction method was carried out by using 0.03N hydrochloric acid as an extraction solvent in combination with 4%w/w of SHMP at 90 ^{o}C for 90 minutes. The corresponding conditions yielded 15.98± 0.02% of dried pectin. The moisture, galacturonic acid and methoxyl contents of extracted pectin were 4.32 ± 0.02%, 66.28 ± 1.53% and 6.68±1.54%,respectively. These properties were approximately the same as the commercial pectin which were in the range of standard pectin specified by the Joint/WHO Expert Committee on Food Additive (JECFA). Furthermore, the average of lightness, the redness (a*) and the yellowness (b*) of pectin were also analyzed and these values were 66.41 ± 1.63, 7.46 ± 1.62 and 26.97 ± 1.79, respectively. The measured viscosity was also similar to the standard grade 150 pectin. Moreover, the biofilm from the mixture of extracted pectin, tapioca starch and glycerol was produced by the casting process. The smooth film was obtained as a pale yellow color and the thickness of the film was 0.0221 ± 0.0032 mm. The tensile strength of the film was shown to be 19.20 ± 1.06 N/mm^2 and the water resistance time of the film was 42 ± 0.12 s. From the resulting film's properties, the biofilm from extracted pectin from okra may be practically useful for the applications in the medicinal and industrial uses in the future.

Introduction

Pectin is a polymer compound found in plants. It is one of carbohydrate compounds that can be extracted from citrus peel and apple. Pectin acts as a cellular structure. A special property of pectin is that when it is dissolved in water, it can swell into a gel. It has been widely applied in the industry.

Pectin production in Thailand is still not sufficient to meet the demand and must still need to import pectin from abroad at high prices. Industrial grade pectin normally costs about 3,800 bahts per kilogram, while pharmaceutical grade pectin costs about 6,650-10,161 bahts per kilogram. (Fluka, Germany, 2552)

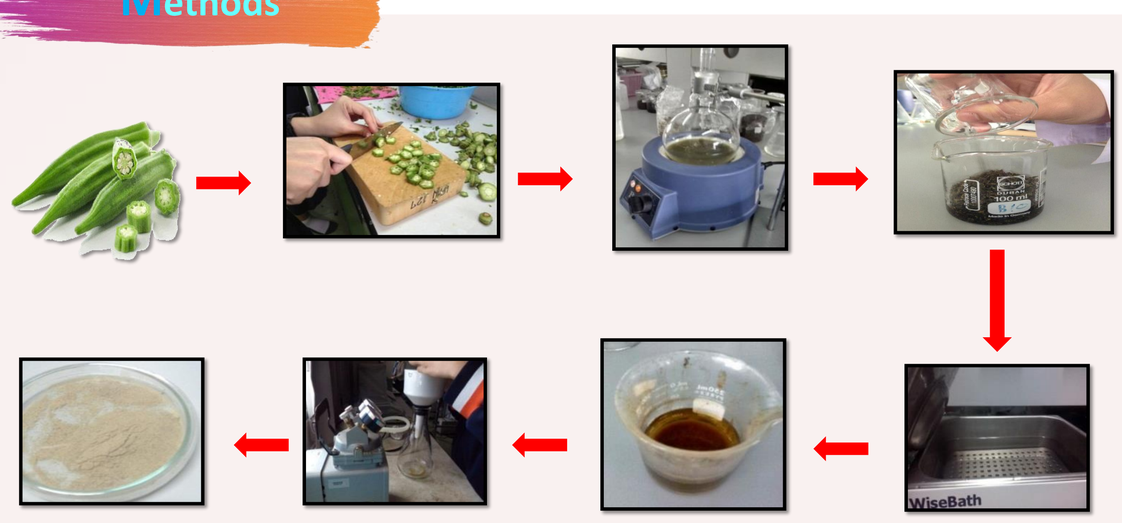
Phornprapa Chunthanom et al. studied the extraction procedure of pectin from Manoi leaf in the PhuPhan mountain area. It was found that pectin from Manoi leaf was suitable for the production of healthy beverages.

Based on the findings as mentioned above, researchers would like to study and extract pectin from okra which is one of local plants, common and fast growing. Okra is one of interesting plants that can be used to extract pectin in order to be utilized in the medical and industry in the future.

Objectives

1. To Study the optimal conditions for pectin extraction from Okra
2. To Determination physical and chemical properties of extracted pectin to commercial pectin
3. To Study the properties of Okra pectin film

Methods



1. Find the optimal conditions for pectin extraction from Okra ; acid type, acid concentration, pH, time, temperature, % Sodiumhexametaphosphate.
2. Study the important physical (viscosity, lightness) and chemical properties(%yield, %moisture, %ash, %methoxyl, %galacturonic acid) of extracted pectin and campare to commercial pectin.
3. Find the best way to form edible pectin film.

Results and Discussion

The results from the study of optimum condition, characteristics of extracted pectin from okra and its application were presented as followed;

Part 1:For the optimum condition of pectin extraction from okra, hydrochloric acid was used for the extraction with the percentage yield of 9.97% pectin. The optimal concentration of acid was 0.03 N of HCl with %yield of 10.94%. After adjusted pH to 3, the extraction gave %yield for 11.39%.After the solution was boiled at 90ºC, the yield was increased to 12.69%. The best boiling time were 90 minutes giving yield of 12.69%. It was also found that when sodium hexametaphosphate was added to increase the extraction efficiency, percentage yield was increased to 15.98%.

Part 2: It was observed that most physical and chemical properties of pectin extract from okra was similar to commercial pectin, except for ash content, but these were in range of standard level. (Table 1 - 3)

Type of pectin	Pectin extract from okra (%)	Moisture (%)	Ash content (%)	Methoxyl(%)	Galacturonicacid(%)
Standard pectin	-	-	2.0	>2.5	>65
Industrial grade pectin	22.55	4.26	3.59	5.08	69.89
Lab and pharmaceutical	-	4.81	2.23	6.29	78.54
Pectin from Okra	15.98 ±0.02	4.32 ±0.02	4.12 ±0.02	6.68 ±1.54	66.28 ±1.53

Table 1: Chemical properties of pectin extracted from okra compared to standard commercial pectin.

Type of pectin	Viscosity at pectin concentration			
	0.5%	1.0%	1.5%	2.0%
From Okra	33.96 ± 0.02	68.46 ± 0.02	119.35 ± 0.02	176.96 ± 0.01
From orange grade 150	35.12 ± 0.01	72.35 ± 0.01	128.47 ± 0.01	186.42 ± 0.01

Table 2:Viscosity of pectin extract from okra and commercial pectin (orange grade 150)

Type of pectin	Color values[1]		
	L*	a*	b*
From Okra	66.41 ± 1.63	7.46 ± 1.62	26.97 ± 1.79
From orange grade 150	82.77 ± 0.00	3.14 ± 0.00	18.92 ± 0.00

Table 3:Color values of pectin extract from okra and commercial pectin(orange grade 150)

Note :[1]CIE color value : L* = brightness (100 = bright, 0 = dark) a* = (+) Red, (-) Green b* = (+) Yellow, (-) Blue

Part 3: The property of biofilm from the mixture of extracted pectin from okra and some characteristics was studied. It was indicated that the biofilm from okra had similar physical appearance as compared to commercial pectin which was in range of standard pectin. (Table 4)

Type of degradable film	Thickness (mm)	Water permeability (second)	Tensile strength (N/mm^2)	Physical of the film
standard pectin	0.0228 ± 0.0021	45 ± 0.11	15.20 ± 0.44	
Pectin from Okra	0.0221 ± 0.0032	42 ± 0.12	19.20 ± 1.06	

Conclusions

The appropriate condition for pectin extraction from okra was 0.03 N hydrochloric at pH 3.0 and 90 ^{o}C with 4% sodium metaphosphate which producedpercentage yield of pectin for 15.98 ± 0.02%. The study of some properties showed that pectin from okra had similar characteristics as compared to industrial pectin, except for ash content. However, it was in the range of standard pectin which was close to pectin from orange peel grade 150. Pectin extracted from okrawas useful in industry and could be applied to bioplastic production. Moreover, the import of pectin to the country could be decreased.

References

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