International Journal of Computer Applications Technology and Research
Volume 12–Issue 03, 53-55, 2023, ISSN:-2319–8656
DOI:10.7753/IJCATR1203.1012

The Analysis of Inulin From Yam Tubers using FTIR (FOURIER TRANSFORM INFRA RED)

Irving Josafat Alexander
Physics Education Program
HKBP Nommensen University
Medan, Indonesia

Rumondang Bulan
Chemistry Department
University of North Sumatera
Medan, Indonesia

Emma Zaidar
Chemistry Department
University of North Sumatera
Medan, Indonesia

Ramlan Silaban
Department of Chemisitry
State University of Medan
Medan, Indonesia

Timotius Agung Soripada
Artha Medica Hospital
Binjai, Indonesia

Gloria Sirait
Biology Education Program
HKBP Nommensen University
PematangSiantar, Indonesia

Abstract: Research on inulin which was isolated from yam tubers (Pachyrhizuserorus).This research is a experimental laboratory research. The Qualitative Analysis of Inulin is Reduction Sugar make a Bennedictand The Quantitative Analysis Inulin was isolated from yam tubers is characterized by using Forrier Transform Infra Red (FTIR).

Keywords: inulin, yam tubers, reduction sugar, benedict, forrier transform infra red

1. INTRODUCTION

In recent years, probiotic functional foods have gained quite a popularity and become a preferred choice among consumers, due to their positive effects on the gut microbiota and overall health. However, it is imperative for a probiotic strain to remain live and active at the time of consumption in high enough population density, in order to provide such health benefits [3].

Inulin as a prebiotic provides important benefits in the body because it can bind air from several important polysaccharides in maintaining air in the stomach. Given its various health benefits, it is unsurprising that researchers have already begun investigating the potential uses of inulin in food products. Inulin has been used a successful fat substitute and as a dietary fibre in breakfast cereals, yoghurts, cheeses, and even chocolate. Some countries already have rules regarding the standard amount of prebiotics consumed mainly inulin. Inulin is a type of prebiotic that is widely used in food products so it needs to be added to the appropriate level for processed food products such as fermented milk. The level of administration of inulin is very important to know to get the optimal amount of inulin which is beneficial for the health of the body[5]. The beneficial physiological functions of this inulin-type prebiotic also included management of diabetes mellitus and obesity as well as improvement of serum lipids concentrations and mineral absorption [1]

As concept introduced by Gibson & Roberfroid (1995), prebiotics are nondigestible food ingredients that beneficially influence the host by stimulating the growth and/or activity of a limited number of bacteria species resident in the colon, and thus improve host health. This definition has been revised along the time, but the main features have mostly been retained. The great interest in the development of prebiotics is aimed at nondigestible oligosaccharides. Some of the prebiotics are the inulin-type fructans, because they provided evidence of their ability to change the gut flora composition after a short feeding period based on results from in vitro studies and human subjects. Inulinis a versatile fructooligosaccharide generally extracted from chicory that is applied in the stabilization of proteins and modified drug delivery. Another interesting carbohydrate for encapsulation is inulin, a polysaccharide composed of fructose units linked by-(2,1) bonds and containing a glucose unit. Inulin can be commercially obtained from chicory and has prebiotic effects, dietary fiber actions ,among other health related benefits [4]. Although inulin has several applications in diverse areas, including in the food area for decades, the use of inulin as wall material in the food field is a few exploited. Wall materials commonly used in the en-capsulation of bioactive compounds are gums, modified starches,whey proteins and dextrins [2]. However, such substances do not present functional activities as inulin does. Looking for the substitution of gums, maltodextrinor starches by prebiotic materials, some researchers are studying the use of inulin. Recently, Fernandes, Borges, & Botrel (2014a) evaluated theeffects of the partial or total replacement of gum Arabic by inulin onthe characteristics of rosemary essential oil microencapsulated by spray-drying. Saénz, Tapia, Chávez, & Robert (2009) also reported theability of inulin for microencapsulation of bioactive compounds from cactus pear fruit. Thus, the use of inulin can favor the application oforegano extract in functional [7]

2. METHOD

2.1 Tools and Materials

The materials that needed in this study were yam tuber.

2.2 Preparation of yam bulbs extract

The first step that carried out in this study was the extraction process of the yam. About ±1000 grams of yam tuber sample that has been cut, then peeled and washed thoroughly.

International Journal of Computer Applications Technology and Research
Volume 12–Issue 03, 53-55, 2023, ISSN:-2319–8656
DOI:10.7753/IJCATR1203.1012

2.3 Isolation inulin of a yam tubers extract

The next step is yam tuber mixed with 1:2 (b:v) water. Then, it is heated to a water bath at a temperature of 80ºC for ± 30 minutes. After being cold, the filtrate is taken and filtered. The filtrate is then dissolved in 30% ethanol by 40% of the filtrate volume. The solute is stored at 0ºC for ±18 hours. The solute is left at temperatures' room for 2 hours or allowed to stand until come such of sediment. The precipitate that obtained is wet inulin 1 which is then reconstituted with water, with a ratio of 1:2 (b:v). Furthermore, the next process is same as above to obtain wet inulin II. In the final stage, wet inulin II was dried at 50ºC for 6-7 hours and been smoothed to become inulin powder.

2.4 Analysis of Inluin with Bennedict (Qualitative)

1 gram of inulin is dissolved in 10 mL aqquades and then taken as 5 drops and added to 5 mL of Benedict's solution then heated in a water bath for 5 minutes. Brownish-red precipitate shows a positive test for reducing sugars

2.5 Analysis of Inulin Function with FT-IR Spectroscopy

Inulin has been prepared in the form of mull. The slurry is examined in a thin filet placed between flat salt plates. The test is done by clamping the mixed film on the sample site. Then, the film is placed on the plate in a way of infrared light. The result is then recorded to a paper in the form of a curve wave 4000-200cm^{-4} to the intensity. Insulin that has been produced from yams is characterized by a functional group using a forrie transform infra red (FTIR) device at 4000-500cm^{-1} wave number.

3. RESULTS AND DISCUSSION

3.1 Results of Inulin Isolation from Yam Bulbs

The results of inulin isolation from yam tubers as much as 1059 grams obtained 23,298 grams of pure inulin (2.23% of the initial mass of yam tuber samples that used in this study). Inulin isolation included the extraction process using aquadest solvent and dissolved with 30% ethanol solvent in the sample. This isolation process produces pure white inulin. The results of inulin isolation that obtained from the study can be seen in the following figure.

Figure 1. Inulin was isolated from yam bulbs

3.2 Results of Inulin Analysis with Bennedict Solution

The results of a qualitative test of reducing sugars using Benedict reagents produce a brownish-red precipitate after heating for 5 minutes on a water bath indicating the presence of inulin.

The results of inulin isolation from yam tuber as much as 1059 grams obtained 23,298 grams of pure inulin (2.23% of the initial mass of yam tuber samples used in this study). Yam tubers (Pachyrhizus erosus) is one of the tubers which contains inulin. This yam tuber (Pachyrhizus erosus) contains hypoglycemic substances niacin, inulin, fiber, calcium and vitamin C which can reduce blood glucose levels and can increase the weight of patients with hyperglycemia.

3.3 Results of Inulin Analysis with FTIR (Forrier Transform Infra Red)

The results of the functional group analysis of inulin from tubers of dahlia and inulin tubers using the *Fourier Transform Infra Red Spectroscopy* (FTIR) can be seen in the Figure 2, and inulin wave numbers of dahlia tubers and inulin tubers can be seen in Table 1 below.

Table 1. Wavenumber of Yam Tuber Inulin and Commercial Inulin

Number	Wavenumber (cm^{-1})		Fuctional Groups
	Commercial Inulin	Yam Tuber Inulin	
1	3371.57	3402.43	O-H
2	2931.80	2924.09	C-H
3	1126.43	1157.29	C-O
4	1026.13	1018.41	C-O

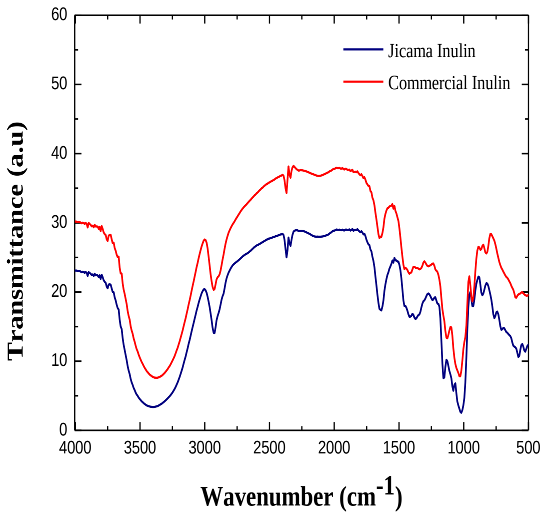

Figure 2. The FTIR Spectra of inulin from yam tubers

In the analysis of functional groups using FTIR for both inulin spectra of yam tuber and commercial inulin showed that there was no significant difference between inulin bands of commercial yam tuber and inulin. This is because the two types are both inulin. The results of the analysis of both inulin samples using FTIR spectroscopy showed that the presence of a widening band in the absorption area of 3371.57 cm^{-1} in commercial inulin and 3402.43 cm^{-1} in inulin from yam tuber which showed the presence of O-H strain vibrations from the alcohol structure. In the molecule followed from the vibration of the C-H strain of the alkane chain in the absorption area of 2931.80 cm^{-1} in commercial inulin and 2924.09 cm^{-1} in inulin from yam tuber. The peak of vibration was also seen in the absorption areas 1126.43 and 1026.13 cm^{-1} in commercial inulin and 1157.29 and 1018.41 in inulin from yam tuber which showed strain (C- O) in this FTIR spectrum from yam tuber.

FTIR spectroscopy may be an option very good among other techniques where This technique is very efficient because it is easy to use, fast and cheap. The spectrum generated from FTIR is data a very complex depiction of the character and identity of a natural substance as a whole based on its composition. that difference exist in the spectral pattern, the position of the absorption peak and its intensity in the FTIR spectrum describes there is a difference in chemical composition natural ingredients. Therefore, the FTIR spectrum can be used to distinguish one substance with the others [6].

4. CONCLUSION

1. The results of inulin isolation from yam tuber as much as 1059 grams obtained 23,298 grams of pure inulin (2.23% of the initial mass of yam tuber samples used in this study). Yam tuber (Pachyrhizus erosus) is one of the tubers which contains inulin.
2. In the analysis of functional groups using FTIR for both inulin spectra of yam tuber and commercial inulin showed that there was no significant difference between inulin bands of commercial yam tuber and inulin.

5. REFERENCES

[1] Dominguez AL , Rodrigues LR , Lima NM, Teixeira JA. 2014. An overview of the recent developments on fructo oligosaccharide production and applications. *Food Bioprocess Technol, 7 (2014), pp. 324-337*

[2] Chranioti C, Nikoloudaki A, Tzia C. 2015. Saffron and beetroot extracts encapsulate dinmaltodextrin, gum Arabic, modified starch and chitosan: Incorporation in achewing gum system. *Carbohydrate Polymers,127,252–263*

[3] Karimi R, Azizi MH, Ghasemlouc M, Vaziri M. 2015. Application of inulin in cheese as prebiotic, fat replacer and texturizer: A review. *Carbohydrate Polymers, 119, 85–100*

[4] Lacerdaa ECQ, Caladob VMA, Monteiroc M, Finotellid PV, Torresa AG, Perrone D. 2016. Starch, inulin and maltodextrinas encapsulating agents affect the quality and stability of jussara pulp microparticles. *Carbohydrate Polymers 151(2016) 500–51*

[5] Majeed M., Majeed S, Nagabushanam K, Arumugam S, Beede K, Ali F. 2019. Evaluation of probiotic Bacillus coagulans MTCC 5856 viability after tea and coffee brewing and its growth in GT hostile environment. *Food Research International 121 (2019) 497-505*

[6] Triawan Deni Agus., Ghufira Ghufira., Adfa Morina ., Rafi Mohamad. 2022. Pencirian Kopi Robusta Bengkulu dari Kemungkinan Bahan Pencampur Menggunakan Kombinasi Spektroskopi FTIR dan Kemometrik. agriTECH, 42 (4) 2022, 321-328

[7] Zabota GL., Silva EK, Azevedob VM, Meireles AA. 2016. Replacing modified starch by inulin as prebiotic encapsulant matrix oflipophilic bioactive compounds. *Food Research International 85 (2016) 26-35*