PROCEEDING

INTERNATIONAL SEMINAR ON SCIENCE AND TECHNOLOGY 2014

October 23, 2014

Tegalboto Campus, University of Jember
Jember, Indonesia

UNIVERSITAS JEMBER 1964-2014

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Proceeding of The International Seminar on Science & Technology 2014 (**ISOSTECH '14**)

The editing of this proceeding has been carried out by **Siswoyo & B. Kuswandi** with assisted by the Scientific Committee of ISOSTECH'14.

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Foreword by Organising Committee

Assalamu'alaikum Wr. Wb.

Distinguished guests and delegates

On behalf of the organizing committee, I am deeply grateful to your present in the International Seminar on Science & Technology 2014 (**ISOSTECH '14**) that already held in Universitas Jember, Jember Indonesia on thirsday, 23 October 2014.

The **ISOSTECH '14** is jointly seminar between University of Jember (UNEJ), Indonesia and Universiti Sains Islam Malalaysia (USIM), it was arranged with substantive elements such as seminar pertaining to current advance on science and technology together with posters.

The seminar was provide an excellent platform for knowledge exchange between the academicians, researchers, scientists and engineers working in areas of mathematic and basic sciences, agricultural and food Technology, health sciences and enggineering as well as information technology. In addition, it provides an opportunity for the participants from Indonesia, Malaysia and Philiphine to share research findings, to establish networking and to encourage academic and student exchange and other participation in this exciting seminar.

We also would like to express our deep appreciation to the all organising committee members and steering committee, especially Dr. Zulfikar, on behalf of Rector, as Vice Rector of UNEJ who officially opens this seminar. Last but not least our appreciation to all participants especially delegate from USIM, IIU Malaysia and San Carlos University, Philiphines. We convey our great gratitude for your scientific speech and contribution. We do hope that all these research results are useful for further research progress and development in these fields.

Enjoy the conference proceeding and hope it will give inpiration on your research projects.

Wassalamu'alaikum Wr. Wb.

Mrs. L. Wulandary
Chairperson
University of Jember

Preface

The first International Seminar On Science & Technology 2014 (**ISOSTECH '14**), took place in University of Jember, Jember East Java Indonesia on 23 October 2014. This first seminar series is focused on all aspects related to recent advance in science and technology.

This proceeding contains papers that have been presented at **ISOSTECH '14** as plenary lectures, invited, oral and poster presentations. About 100 participants attended the conference, with 4 plenary lectures, 35 oral and 24 poster presentations. The proceeding of **ISOSTECH '14** has been published in electronic form as *.pdf file for simple and easy publication and to avoid heavy book of proceeding. We hope that this publication can be easily read, handled and transferred to other form. Furthermore, this paperless proceeding can be fruitful for all participants of the conference.

My sincerely thanks go to all the members of Scientific Committee for their valuable help in the review of the submitted papers, and also to the authors for their collaborative attitude. A special mention must go to **Mrs. L Wulandary**, our Conference Chairperson, who has put in a terrific amount of effort not only in general conference matter but also in the assembly of the papers for this proceeding. Finally, I congratulate the authors of all papers for producing the new and novel idea for research on mathematic and basic sciences, agricultural and food Technology, health sciences and enggineering as well as information technology.

Jember, October 2014

Siswoyo & B. Kuswandi
Editors

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INFORMATION TECHNOLOGY AND ENGINEERING

HEALTH AND APPLIED SCIENCES

POSTER SESSION

PP eco-friendly Extraction of Banana Agro-industry Waste and its Functional Groups

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Abstract **-** Pectin or pectic polysaccharides is a naturally-occurring polysacharride found in many plants. Its effects on health is receiving growing interest for their applications such as prebiotic ingredient. In this work, pectin was isolated from banana agro-industry waste (peel and bunches of bananas) by using water extraction method. There were three methods i.e. one time, two times and three times of extraction. The extracted pectin was characterized by FTIR. The result showed that pectin extraction method was twice (two times phase of extraction) as much as the extraction stage effective and efficient to extract the pectin than one or three times extraction. The results of functional groups analysis was using FTIR instrument indicated that the peak of extracted pectin had the same functional group with standard pectin. But there were impurities (ethanol compound) as a effect of the analysis performed on wet samples (pectin has not dried). Functional groups presented in the pectin from banana waste i.e intermolecular alcohol group, a carboxylic acid dimer, free carbonyl, amine compounds and group of primary and secondary aliphatic.

Keywords: eco-friendly extraction, pectin/pectic polysaccharides, FTIR.

1. Introduction

Pectin is a naturally-occurring polysacharride found in many plants. Its effects on health is receiving growing interest for their applications such as prebiotic ingredient. Peel and banches of banana contain pectin up to 4% of the dry weight in the peels [1], and 10% of the dry weight in the bunches [2].

The properties of pectin are soluble in water especially in the hot water [3]. Pectin is used to improve the viscosity, stability, texture, and appearance of food products [4]. Pectin is also used to gel formation and a stabilizer in fruit juices, jelly-making materials, jem and marmalade [5].

Low methoxyl pectins (< 50% esterified) form thermoreversible gels in the presence of calcium ions and at low pH (3–4.5) whereas high methoxyl pectins rapidly form thermally irreversible gels in the presence of sufficient (for example, 65% by weight) sugars such as sucrose and at low pH (< 3.5); the lower the methoxyl content, the slower the set [6].

Extraction of pectin usually done by heating the material at a given temperature in a acid solution such as HCl [7]. Hydrochloric acid solution is less environmentally friendly when used as a solvent to pectin extraction. Hutagalung [1] and Laksono [2] has been extracting pectin from banana peel and bunches at 60^{o}C. While Tuhuloula [8] conducted the pectin of kepok var. banana peel 80^{o}C. Extraction of pectin can be done by extracting a single stage and multi-stage [9]. Extraction of one stage is the extraction with a suitable solvent at the same amount, so it takes a lot of solvent to dissolve the pectin. Ekstraksi is a multi-step solvent extraction with the addition of the new always on the residue from the previous extraction of pectin dapatterekstrak so optimally [10]. Therefore the research used water as the eco friendly solvent to extract the banana pectin with combined temperature (60 ^{o}C and 80^{o}C) and phase extraction (one time, two times and three times).

2. Materials and Methods

2.1 Plant Material

Banana peel and bunches were obtained as a waste material from agroindustry (banana home industry) produced banana unripe chips. The materials were collected from plantain (agung var.) and banana (embug var.). The materials were cut into pieces and dried under shade for 24-48 h, further dried at 30–40ºC until constant weight was obtained. Dried fruit peel was powdered in to electric grater. Powdered peel was further passed from sieve 60 and stored in air tight container until used.

2.2 Eco-friendly Extraction of Pectic polisaccharides (PP)

Pectins were extracted from the cell-wall material (CWM) by sequential extraction with water (1 × 1h; 2 × 1h; 3 × 1 h at 60 ^{o}C) according to the method

established by Emega [11]. All extracts were recovered by filtration and precipitated with four ethanol volumes, providing a water-soluble pectin (WSP) as shown in the fraction scheme (Fig. 1).

2.3 Analysis of Moisture Content of The Banana Peel-Bunches Powder and Yield of Pectin

Moisture content of banana peels and bunches powder were determined by ovendrying [12], using an air-circulated oven at 106 ^{o}C, for 24 h. All values were calculated on a dry-weight basis. Pectins were extracted from the banana peels and bunches by sequential extraction with water. After each extraction step, the insoluble residues were not dried to avoid further irreversible collapse of cell-walls, which can hinder the following extractions. The final residue was dried and weighed. The resulting polysaccharides in the extracts are named water-soluble pectin (WSP). The yield of pectin was calculated on a wet-weight basis based on this formula

Yield (%) = [weight of wet pectin/weight of the powder] × 100.

2.4 Analysis of PP functional groups by the fourier transform IR spectrum (FT-IR)

The Fourier transform IR spectrum (FT-IR) of pectin was recorded using a Bruker Optics ALPHA IR spectrophotometer. The FT-IR was operated in the range of 500 and 4000 cm^{-1} as KBr pellet [13].

One time phase : WSP 1
Two times phase : WSP 1 + WSP 2
Three times phase : WSP 1 + WSP 2 + WSP 3

Fig. 1. Scheme of extraction of pectic polysaccharides from banana peels and bunches

3. Result and Discussion

3.1. Moisture content of banana peels and bunches powder

The moisture content varied based on their characteristic. Characteristic of banana peels was different with banana bunches. The moisture content of the waste banana powder ranged from 8.14 to 9.05% (Figure 2).

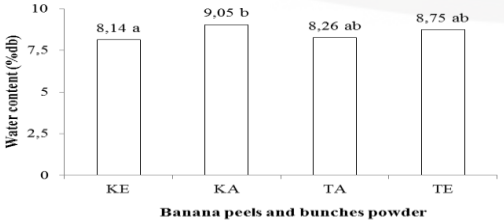

Fig 2. Moisture content of banana peels and bunches powder: agung var peel (KA), embug var peel (KE), agung var bunches (TA), embug var bunches (TE)

Agung var banana peel powder had a higher moisture content (9.05%) was compared with embug var. banana peel (8.14%). The moisture content difference on the banana peel was significantly different after further tested with LSD at the level of $\alpha \leq 5\%$. Embug var. bunches powder had a higher water content (8.75%) than the great banana bunches (8.26%), but was not significantly different at a further test LSD at $\alpha \leq 5\%$ level.

3.2 Effect of varieties and material kind to yield of banana pectin

For peels, the variation in both varieties (agung var. and embug var.) were significant (LSD test) for pectin content (Figure 3). The pectin content of embug var. peel (4.54%) was higher than agung var. peel (4.38%) and showed significantly different after further tested with LSD at the level of $\alpha \leq 5\%$. The pectin content of embug var. bunches (2.76) was higher than the great banana bunches (2.68%) but no significantly different.

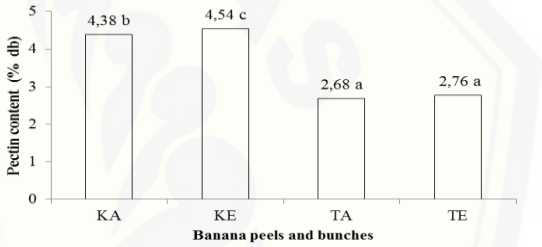

Fig 3. Pectin content of banana peels and bunches powder: agung var peel (KA), embug var peel (KE), agung var bunches (TA), embug var bunches (TE)

The kind of banana also affect pectin content. The banana kind have a higher pectin content than the plantain kind. Tuhuloula [8] reported that the pectin content of ambon var. (banana) was higher than kepok var. (plantain). Physical characteristic showed that ambon var. was more bigger than kepok var., so be expected more protopectin can be hydrolyzed into pectin.

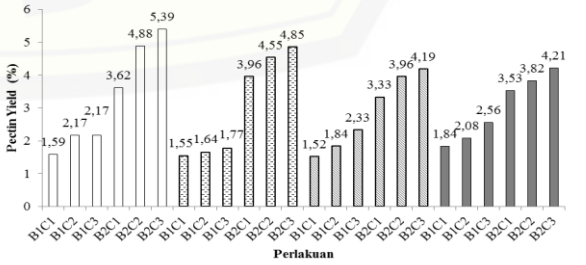

Fig 4. Pectin yield of embug var peel ( ), agung var peel ( ), embug var bunches ( ), agung var bunches ( ) at extraction temperature 60^{o}C (B1), 80^{o}C (B2) for one time phase (C1), two times phase C2) and three times phase (C3).

Figure 4 showed that the pectin extraction was conducted at 80 ^{o}C resulted the greater of pectin yield. These was due to high extraction temperatures help the diffusion of the solvent into the network and increase the activity of the solvent in the pectin hydrolyzing [14]. The increase in kinetic energy resulting in the release of polysaccharides from tissue cells that yield more (Nurdjanah and Usmiati, 2006).

Bernasconi [9] reported that the one phase of extraction method was generally not possible to soluble because was due to the equilibrium between the soluble extracts and the extracts. Extraction would be more beneficial if was done in a many number of stages and each stage uses little solvent. The yield of pectin was obtained with the optimal extraction method two times phase.

3.3 Infrared spectroscopy

IR spectroscopic study revealed the presence of characteristics group in the extracted pectin. Peak of carboxylic acid group easily identified in the banana peel and bunches derived pectin. An overview of the IR spectrum of pectin is shown in Figure 5 the "fingerprint" region of the spectrum (up to approx. 2000 cm^{-1}) includes the region of 1200-1800 cm^{-1} as shown.

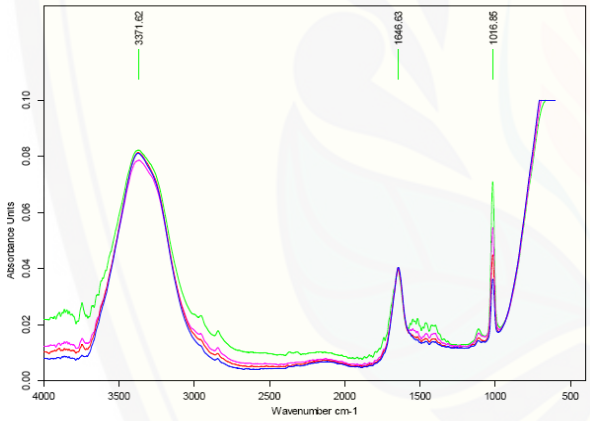

Fig 5. FTIR spectrum of pectin from banana peels and bunches: embug var. peel (--), agung var. peel (--), embug var. bunches (--), agung var. bunches (--)

The result can observed the region that characterizes the state of carboxylic groups (approx. 1750-1350 cm^{-1}). The band at approx. 1743 cm^{-1} was indicative of the stretching group C = O of non-ionized carboxylic acid (methylated or protonated). Its ionization (formation of salt) leads to their disappearance, and the appearance of stretch modes of COO^{-} in approximate 1600-1650 and 1400-1450cm^{-1}, respectively. The degree of methylation (DM) is defined as the amount of ester groups compared to the total amount of acid groups and carboxylic ester and it is observed that the high intensity of the band at 1743 cm^{-1} shows that the pectin obtained is of high degree of methylation.

4. Conclussion

Banana peel contain more pectin than banana bunches at agung and embug var. Two times phase of pectin extraction was more effective and efficient than one time or three times phase. The extracted pectin contain impurities (ethanol compound) as a effect of the analysis performed on wet samples (pectin has not dried). Functional groups presented in the pectin from banana waste i.e intermolecular alcohol group, a carboxylic acid dimer, free carbonyl, amine compounds and group of primary and secondary aliphatic. Further research can be conducted about the rheological study of continuous shear of pectin solution.

5. Acknowledgments

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