

Original Research Article

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## Pectin Isolation from Dry Pod Husk Cacao with Hydrochloride Acid

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### ABSTRACT

#### Keywords

Isolation,  
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Pectin was found in the part of the vegetables or fruits that it was in the pod husk cacao contain 11-15% pectin in dry basis. Pectin isolation could be done with acid, base or another solution look like ammonium sulphate. Dry pectin isolation with hydrochloric acid applied temperature and time extraction were done by Respon Surface Methodology (RSM) which each factor had 5 level with composite design. Hydrochloric acid applied on level 0.653, 1, 1.5, 2 and 2.282 M, temperature applied on level 43.18, 50, 60, 70 and 76.82°C. Extraction time applied on level 3.318, 4, 5, 6 dan 6.282 hours. The base on the optimization by RSM calculation that was pectin recovery about 12% (wet basis) with condition hydrochloric acid 1.58 M, Temperature 62.28°C and Extraction time 4.80 hours. The really dry pectin extraction with condition hydrochloric acid 1.58 M, temperature 62.28°C and extraction time 4.80 hours by RSM that pectin extracted about 11.70%, with methoxyl content 58.45%, galacturonate content 49,87% and clarity 72%.

### Introduction

Fruit of cacao contained seed, pulp and mesocarp or pod husk cacao, especially seed had high economies value which produced chocolate, fat and another products and the pod husk cacao as by product. Pod husk cacao is not to be used new product and unsuitable for animal feed because high cellulose crystallinity was not effectively to be digested. Pod husk cacao was potentially to be cellulose derivative and pectin source. Source of pectin look like Hazelnut Pill (Pardede *et al.*, 2013), apple pomace (Wikiera *et al.*, 2016), Tunisian pomegranate (Abid *et al.*, 2016), orange peel (Hosseini *et al.*, 2016).

Pectin contained in the pod husk cacao 11-15% dry base which potentially to extract as pectin powder. Pectin had an important role to support food industry, cosmetics and medicine. Pectin in food industry as functional food, gelling agent, emulsifier, dehydrating agent, colloids protective and stabilizer. Pectin act as change the viscosity of the solution that increasing the use of pectin (Yuliarti *et al.*, 2015).

Pectin is a polymer of D-galacturonic acid with the 1.4 glycosidic bond (Nelson *et al.*, 1977). Most of the carboxyl group in the polymer having pectin methyl esterification

with (methylated) into methoxyl group, these compounds are referred to as acid pectinase or pectin. Acid pectinase together with sugar and oxygen at high temperatures to form a gel as it did in jam or jelly. The degree of methylation or the carboxyl group is esterified with a methyl determines the temperature of gel formation.

The higher the degree of methylation of the high temperature gel formation. For making jam pectin needed to the degree of methylation of 74, meaning that 74% of the carboxyl group experienced methylation. In the trade, the technical term jelly grade, i.e. the amount of sugar (lb) which is required for the formation of a gel by 1 lb pectin.

Pectin is found in many cells of space between fruits that serve as glue. Isolation of pectin can be done with a variety of solvents such as acetate acid, hydrochloric acid, nitric acid (Yapo and Koffi, 2013), sodium hydroxide, ammonium oxalate (Cut, 2013; Ismail *et al.*, 2012) and other solvents. Isolation of pectin uses extruder screw can also be done (Hwang *et al.*, 1988). Isolation of pectin used Ultrasound assisted extraction (Grassino *et al.*, 2016; Wang *et al.*, 2016), The use of acid will dissolve into protopectin soluble in water. Precipitation of pectin done using alcohol. The purpose of this study is to obtain the optimum conditions of isolation of pectin from cocoa pod husk cacao using hydrochloric acid.

## **Materials and Methods**

### **Materials**

Cacao is obtained from Palolo District Sigi Regency in Central Sulawesi Province Indonesia, which is the type of cocoa beans from a local or Forastero called bulk cacao. Chemical material hydrochloric acid and alcohol absolut are proanalysis quality.

### **Extraction of pectin from pod husk cacao**

The fruit then cut the cocoa pod husk of his shredded with a thickness of about 2 mm that was dried condition. Results slice isolation process using hydrochloric acid. Plan to use the Response Surface Methodology (RSM) with three factors each 5 levels with the level of HCl 0.653, 1, 1.5, 2 and 2,28 M, long time insulation used is 3,318, 4, 5, 6 and 6,282 hours and the temperature insulation is 43.18, 50, 60, 70 and 76,82°C, central composite design (Pinheiro *et al.*, 2008). Furthermore, the results of verification optimization pectin is the isolation and characterization.

### **Determination of yield, methoxyl and clarity**

The yield of pectin obtained from the percentage of pectin after the drying process of wet pectin.

$$\text{Yield} = \frac{\text{Pectin (g)}}{\text{Pod husk cacao (wet) g}} \times 100\%$$

Methoxy levels defined as the amount of methanol contained in the pectin. Methoxy content of the pectin has an important role in determining the functional properties of pectin solution and can affect the structure and texture of pectin gel. Weighed 0.5 grams of dry pectin with 100 ml of distilled water were added 2 ml of 70% alcohol, then heated and shaken. After it has cooled, add 5 drops of phenol phtalien then titrated with 0.05 N NaOH. Equivalent point is marked with a color change from white to brownish pink. The volume of NaOH required is recorded (V1). Then added 20 ml of concentrated HCl and shaken, then the solution is allowed to stand for 15 minutes. The solution was shaken until the pink color disappeared, and add 3 drops of phenol

phthaline and titrated with 0.05 N NaOH arise until the pink color (V2).

$$\text{Methoxy (\%)} = \left( \frac{V_2 \times N\text{-NaOH} \times 31 \times 100\%}{\text{Pectin g} \times 1000} \right)$$

$$\text{Galacturonate Content (\%)} = \left( \frac{(V_1 + V_2) \times N\text{-NaOH} \times 31 \times 100\%}{\text{Pectin g} \times 1000} \right)$$

Clarity was determined transmitten by spectrophotometer as Transmitten (%). The Clarity was reflecting a purity as no colored substance dissolved.

## Results and Discussion

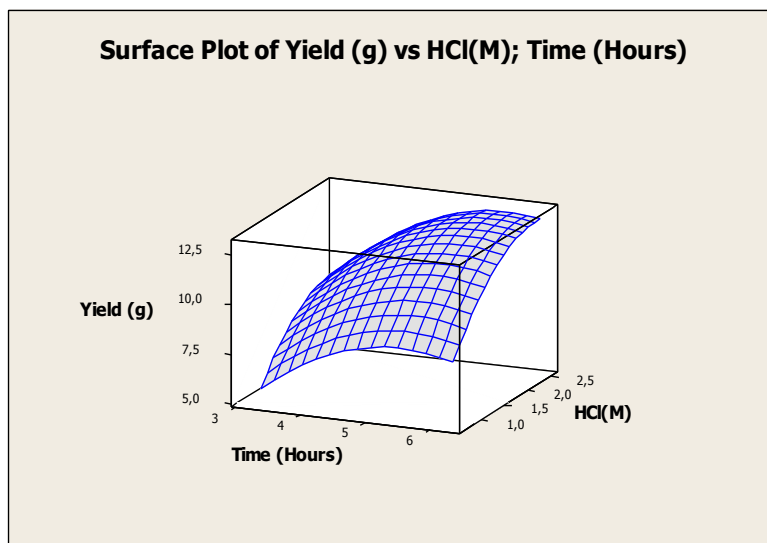
### Dry pectin isolation from pod husk cocoa with HCL

Effect of temperature and HCl in extraction of pectin from cocoa pod husk dry influence on the yield of pectin obtained. The high temperatures used for the extraction of pectin higher revenue yield of pectin obtained and vice versa if the low temperature extraction will yield a low pectin. Time is short extraction will yield a

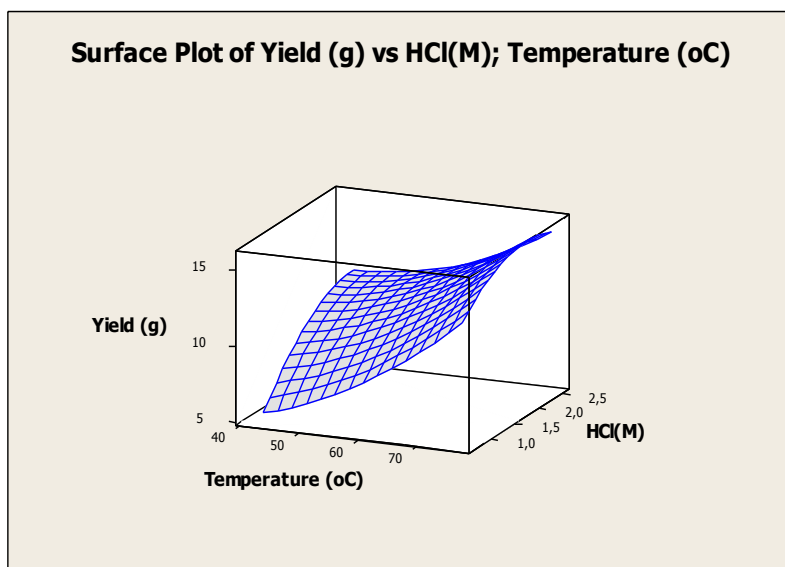
low pectin, whereas the longer the extraction of pectin will yield larger (Figure 1). Based on the analysis of Respon Surface Methodology with conditions for the extraction of pectin using 1.58 M HCl and extraction time was 4.80 hours.

The yield of the isolated pectin is strongly influenced by the time of extraction and concentration of HCl used. The higher the concentration of HCl is used in the extraction of pectin from cocoa pod husk cleaning will increase the yield of pectin to be obtained. To obtain a high yield of pectin with low concentrations of HCl will take a long time, and vice versa with a high concentration of HCl extraction of pectin needed time shorter (Figure 2). The concentration of HCl is higher with the longer time it will decrease yield of pectin obtained (Sulihono *et al.*, 2012). So the isolation of pectin using HCl from the pod husk cocoa would the yield a high (12%) at a concentration of 1.58 M HCl with temperatures 62,28°C based Response Surface Methodology.

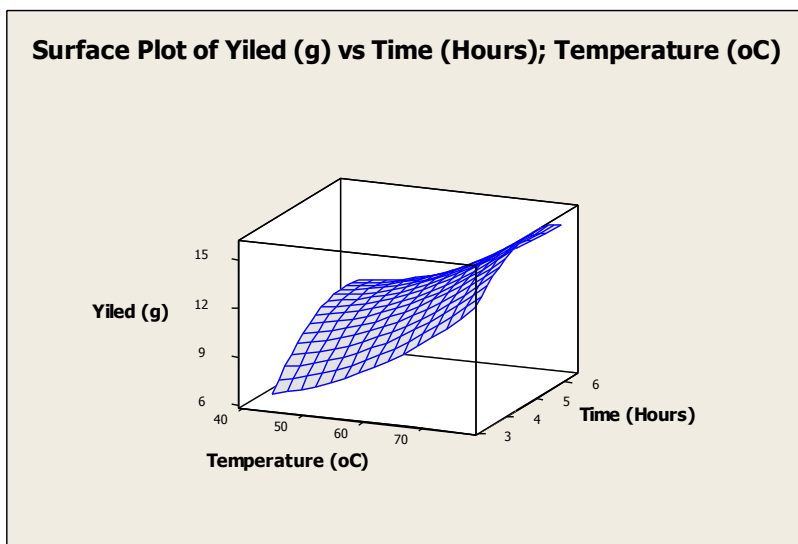
**Fig.1** Effects of Surface Plot Extraction Time and HCl Vs Yield Pectin Results of Dry Pectin Extraction from Pod Husk Cocoa



**Fig.2** Effects of Surface Plot Temperature and HCl Vs Yield Pectin  
Results of Dry Pectin Extraction from Pod Husk Cocoa



**Fig.3** Effects of Surface Plot Temperature and Extraction Time Vs Yield Pectin  
Results of Dry Pectin Extraction from Pod Husk Cocoa



Effect of temperature and time of extraction is also very influential on the isolation of pectin. The low temperature in the extraction of pectin to produce a low yield as well, while the high temperatures during the extraction of pectin will be produced high yield of pectin. When the extraction of pectin long will produce a high yield of

pectin, but the extraction time is too long it will yield slightly decreased pectin (Figure 3). The analysis obtained using Respon Surface Methodology with condition temperature 62, 28°C and time of extraction for 4.80 hours produced the highest yield of pectin about 12%.

Isolation of pectin in dry conditions was needed higher temperatures as 62,28°C, compared to the early research advances temperature used for wet isolation of the cocoa pod husk conditions and the concentration of hydrochloric acid used relatively the same. It is very possible for the release of pectin bind to tissues in the dry conditions would require a longer time compared with the pectin bound on the fresh plant tissue or wet.

In conclusion, isolation of pectin from cocoa pod husk dry conditions with hydrochloric acid 1.58 M, temperature of 62.28°C and extraction time was 4.80 hours, by Respon Surface Methodology calculation would pectin yeild about 12%. After verification with reference to the condition of the pectin isolated yield of 11.70%, with 58.45% of the methoxy content, galacturonate content 49,87% and has the clarity of 72%.

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