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**Revealing the Secrets of Life  
Through Protein and Peptide**

**PROCEEDING**

**INDONESIAN PROTEIN SOCIETY (IPS)  
INTERNATIONAL SEMINAR AND WORKSHOP 2014**

**October 29-30, 2014**

**Jember, Indonesia**

*Editors*

Hardian Susilo Addy

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Toshiharu Hase



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Menuju Insan Berprestasi*



Center for Development of Advanced  
Sciences and Technology,  
University of Jember



Indonesia Protein Society (IPS)

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## Research Article

### Technical Functional Properties of Crude Water Soluble Polysaccharide From Durian Seed (*Durio zibethinus* Murr.)

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#### ABSTRACT

Durian seeds can be utilized as a producer of Water Soluble Polysaccharide (WSP) that can be applied to food products because crude extract of WSP is hydrocolloid. WSP interacts with other components, directly and indirectly affect processing applications, food quality, and acceptance. Water binding, solubility, viscosity and surface activity are important properties, determining usefulness and final product quality in a food system. The absence of extraction conditions that support so that the need for improved methods to variations in temperature and long extraction. This study aim to determine the effect of temperature and long extraction that produces the highest yield value and to determine the functional properties of the WSP. The results of this study are the highest yield values in the 50 oC temperature extraction ang long extraction 2 hours amounted to 2.26%, solubility in water of 51,61%; lightness 34,14; water holding capacity (WHC) 2339,35%; oil holding capacity (OHC) 425,36%; emulsion power 55,77m2/g; emulsion stability 585,50 minutes; foaming power 157,39 ml/g; foaming stability 25,43%. Long extraction increase the value of WHC and OHC but discrease the value of water solubility, foaming power and lightness.

*Keywords: durian seed, water soluble polysacchande, extraction, technical functional properties.*

#### INTRODUCTION

Durian (*Durio zibethinus* Murr.) Is one of the fruits that grow in Indonesia and favored by many people because it is very tasty and smells good. Durian fruit production in Indonesia in 2010 reached 492 139 tons / year, in 2012 increased to 834 011 tonnes / year (BPS, 2012). So far only consumed durian flesh alone, while the seeds are discarded and not used.

Winarti and Purnomo (2006) states that the durian seeds contain a chemical composition that is sufficient potential as a source of nutrition, namely: 9.79% protein, 30% carbohydrate, 0.27% calcium, and phosphorus 0.9% and 59.04% mucous the main components of the water-soluble polysaccharide (WSP). WSP content in durian seeds has the potential to be used as an alternative source of food additives to improve the quality of food as a thickener, stabilizer and forming texture, besides the WSP is a water-soluble dietary fiber that is not enzymatically degraded into sub-units that can be absorbed in the stomach and small intestine (Trowel, 1976; Stephen, 1995).

WSP extraction of durian seeds can be done using water solvent because it dissolves in water. To get the optimal extraction of the necessary conditions for the extraction of the support, is the temperature and duration of extraction (Earle et al., 1994). High extraction temperatures will increase the kinetic energy of the solution so that the solvent diffusion into tissue cells will increase, this process resulted in the cell contents will dissolve or go out because of the difference between the concentration of the solution in the cell to outside the cell (Miryanti et al., 2011).

Another factor affecting the extraction process is the extraction time, the longer time the opportunity for contact between the extraction solvent and the larger materials so that more components of the cell will be extracted out of the tissue, but the temperature and extraction time is too high will cause damage to components extracted (Kirk and Othmer, 1998).

The purpose of this study was to determine the effect of temperature on the yield of crude extract WSP durian seeds and determine the effect of extraction time on yield and functional properties of WSP technically crude extract from seed durian

## RESEARCH METHODS

### *Materials and tools*

The material used is the durian seed types Petruk from the village Pakusari, District of Jember. Chemicals used were distilled water, phosphate buffer solution of 0.05 M and 0.1 M pH 7 (Sigma), 0.1% SDS (Sigma), 97% ethanol (technical), 1M HCl (Merck), 1M NaOH (Merck) and oil (addition the company).

Tools used include analytical balance (Ohaus), filter cloth, centrifuged (Medifriger), spectrophotometer (UV-1800), blender (National), petridish, measuring cups (Herma), refrigerator (Sharp), beaker glass (Pyrex), measuring pipette (Pyrex), micro pipette (Socorex Switzerland), Ostwald viscometer, universal pH indicator (Macherey Nagel), stopwatch, thermometer, stirrer rod BC 24, vortex maxi type 16700, aerator, oven, color reader (type Minolta CR-300), hot plate (Gerhard).

### *Extraction of Crude Extract WSP from Durian Seeds*

Stage 1. durian fruit seeds sorted, washed and peeled to clean. Then do the destruction of distilled water were added to the appropriate solvent treatment (temperature 30, 40, and 50 ° C) with a comparison between materials with a solvent is 1: 2 to become Slury .. After filtering the filtrate and residue results. Obtained filtrate centrifuged at 4500 rpm for 20 minutes. From the obtained precipitate and supernatant were then separated. After that is done clotting process supernatant using 97% ethanol with the ratio between the supernatant and ethanol at (1: 4). Then allowed to stand for 30 minutes then the resulting crude extract WSP wet durian seeds. After the crude extract WSP durian seeds soaked dried using an oven with a temperature of 50°C for 24 hours to obtain a crude extrac WSP of dried durian seed.

Stage 2. Extraction of WSP based best extraction temperature (stage 1), followed by using the long times extraction (0, 1, and 2 hours). The crude extract WSP from durian seed yield produced is calculated, and characterized the technical functional properties, namely: water solubility, viscosity, power and emulsion stability, power and foam stability, lightness, OHC and WHC.

### *Testing Procedure and Data Analysis*

The variables measured were: 1) Yield (Amin et al., 2007); 2) Solubility in water (Subagio, et al., 2009); 3) viscosity (AOAC, 1997); 4) power and satabilitas emulsion (Parkington et al., 2000); 5) the power and stability of the emulsion (Parkington et al., 2000); 6) the lightness of the color (color

reader); 7) WHC (modification); and 8) OHC (modification). The data obtained in the average and standard deviation, then tested descriptively shown in the form of histograms and line charts.

## RESULTS AND DISCUSSION

### *Effect of Extraction Temperature Variation on The Yield of Crude Extract WSP From Durian Seeds*

Research WSP crude extract durian seed stage 1 aims to obtain the extraction temperature variations that produce the greatest yield of WSP will be used in Phase 2. WSP yield calculation results can be seen in Figure 1.

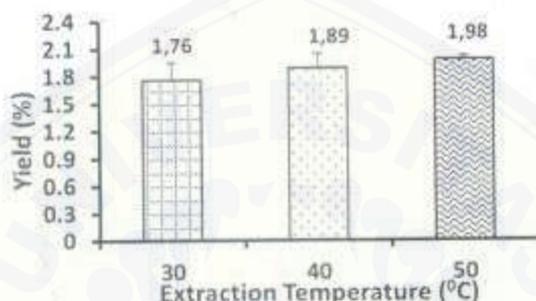


Figure 1. Histogram yield of Crude Extract from Durian Seeds Extracted with Temperature Variation Extraction

Figure 1. states that the value of the yield of crude extract WSP durian seeds at a temperature of 30°C, 40°C, and 50°C respectively of 1.76%; 1.89%; and 1.98%. At a temperature of 30 °C and 40 °C values obtained yield is lower than the temperature of 50°C, this is due to the presence of WSP compounds contained in durian fruit seeds still extracted partly because the solvent used in the extraction process is not working optimally in the extract compound that WSP contained in the seeds of durian.

Solubility WSP compounds contained in durian seeds will increase with an increase in temperature. High extraction temperatures will increase the kinetic energy of the solution so that the solvent diffusion into tissue cells will be increasing as well. This process will result in the contents of the cell will be late or out because of the difference between the concentration of the solution in the cell to outside the cell. High concentration solution will be forced out and replaced by a solvent with a low concentration (diffusion process). The incident is repeated until there is a balance between the concentration of the solution outside the cell and in the cell (Miryanti *et al.*, 2011). However, if the temperature is raised to a temperature of 55°C starch existing in durian seeds will undergo gelatinization process which resulted in increasing the viscosity of the slurry. This will complicate the separation of pulp and WSP extracted filtrate thus absorbed by the pulp and caused a decline in the value of the yield obtained.

Based on the statistical test result that the three treatments were not significantly different, which means the temperature does not affect the yield of crude extract WSP durian seeds. Martha (2012) stated that the increase in temperature (60-80°C). does not affect the yield of the resulting coffee leather WSP For the next two stages of the research conducted using the temperature with the highest yield gains 50°C temperature.

### *Effect of Extraction Long Times Variation on The Yild of Crude Extract WSP From Durian Seeds*

Phase 2 study conducted to obtain the yield of crude extract WSP from durian seeds. Long time extraction variations used were 5, 65 and 125 minutes. Observations durian seed yield WSP based long extraction can be seen in Figure 2. From Figure 2 it can be seen that the yield of crude extract WSP long times extraction 5 minutes, 65 minutes, and 125 minutes respectively by 1.94%; 2.11%; and 2.26%. In these data indicate that the longer the time of extraction is used, the higher the amount of the value of WSP seed yield of crude extract durian seeds. This is indicated in the treatment of extraction time 5 minutes and 65 minutes that the value of the lower yield.

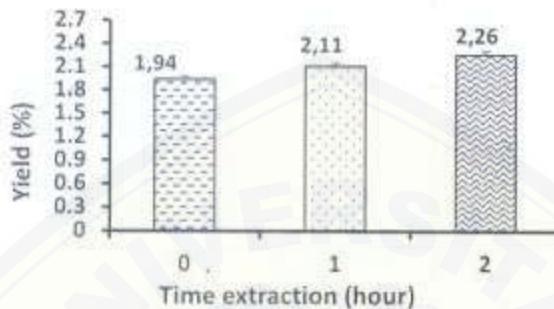


Figure 2. Histogram yield crude extract WSP from durian seed extracted with long times variation extraction

The use of extraction time can increase the kinetic energy extraction solution so that the diffusion of the solution into the tissue cells also increased. This is what led to the increasing number of WSP were detached from the plant tissue. Based on the statistical test result that longer treatment effect on the yield of extraction of crude extract WSP from durian seeds, Long extraction statistically influence on the level of 5% of the yield of polysaccharide gum tamarin (Agustin, 2006). The longer it goes, the higher the extraction of polysaccharides obtained number. Therefore, the extraction time 125 min obtained the highest yield value.

### *Effect of Extraction Long Times Variation on The Solubility in Water of Crude Extract WSP From Durian Seeds*

WSP has a hydrophilic molecule with a number of free hydroxyl groups that can form hydrogen bonds with water (Trowel, 1976). Similarly, the hydrophilic proteins caused by the chain having polar groups such as carbonyl, hydroxyl, amino, and carboxyl that can form hydrogen bonds with water.

Figure 3 obtained results in water solubility values WSP from durian seeds on the extraction time of 5 minutes, 65 minutes, and 125 minutes, respectively for 51.61%; 48.53% and 47.74%. Reduced solubility is due to the heat so that the hydrophilic molecules at the protein turns into a hydrophobic molecule and cause the protein soluble in water. Solubility WSP is lower than the coffee that is worth 63.27. Solubility values is shown in Figure 3.

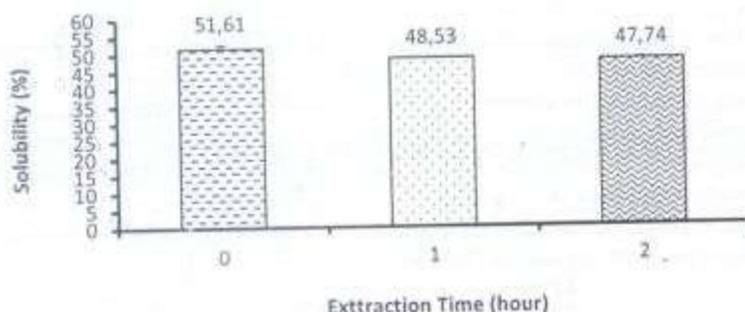


Figure 3. Histogram Water solubility of Crude Extract WSP from Durian Seed Extracted with long times Variation Extraction

Based on the statistical test result that the longer the extraction treatment effect on the water solubility of crude extract WSP from durian seeds. According Rahmawati (2012), long times extraction WSP affect the solubility of the coffee. WSP solubility values on a long leather coffee extraction 0 hours higher than 6 hours, this means that the longer the extraction time it will lower the value of the solubility of WSP.

**Effect of Extraction Long Times Variation on The Viscosity of Crude Extract WSP From Durian Seeds**

According to Einstein's law, is influenced by the viscosity of the solution phase dispersed in solution and not be influenced by the molecular structure of branched chain or straight chain (Gregor and Greenwood, 1980). WSP viscosity is determined by the amount of polysaccharide segments that intersect and interact as a result of the influence of temperature. Viscosity values based on the temperature is shown in Figure 4.

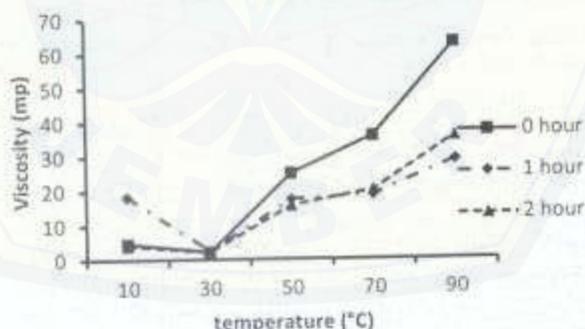


Figure 4. Graph Viscosity of Crude Extract WSP from Durian Seeds at Various Temperature Variations

Viscosity based on temperature in all treatments showed the same relative value. In cold conditions (temperature 10°C) occurs cold conditions so that the viscosity becomes high. At room temperature (30°C) produced low viscosity due to the temperature of WSP melt viscosity. At a temperature of 50°C-90°C an increase in viscosity. The increase in temperature causes the hydrocolloid gel because WSP is capable of absorbing water. At room temperature (30 °C) viscosity grades of WSP lower durian fruit seeds in the amount of 4.107 mp compared WSP from *Dioscorea esculenta* which have a value of 22.89 mp.

### Effect of Variation Long Times Extraction of Crude Extract WSP from Durian Fruit Seeds at Various pH Treatment

The viscosity of WSP from durian seeds showed the same tendency with various pH changes that occur (range 3-11). Figure 5 shows that the viscosity increased at pH 3 to 9 and decreased at pH 11. The viscosity is highest at pH 9. The WSP is also stable at pH 7 and 9 with consecutive values 22.255 and 35.881 mp mp. The tendency of viscosity based on the pH of each different material.

With the carboxyl group (COOH) in WSP, WSP molecules causes easily degraded by extremes of pH changes in the acidic or alkaline pH which is characterized by decreasing the viscosity of the resulting value. Low viscosity due to protein denaturation by acid and alkaline pH extremes. The viscosity of the WSP durian seeds slightly similar to the WSP from *Dioscorea esculenta* which has the highest viscosity value at pH 7 and 9. Based on the viscosity values obtained by the WSP durian seeds can be used in food products that have a neutral and slightly alkaline pH. Viscosity values based on the temperature is shown in Figure 5.

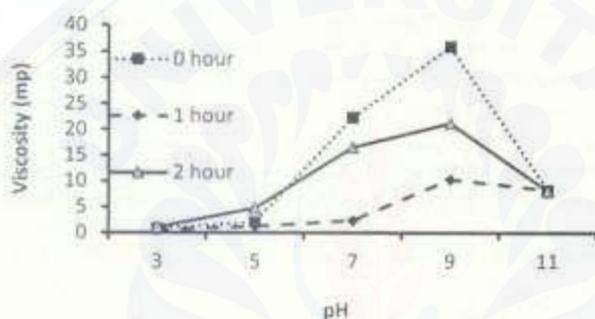


Figure 5. Graph Viscosity of Crude Extract WSP from Durian Seeds at Various pH variation

### Effect of Variations Long Times Extraction for Emulsion Power and Emulsion Stability of Crude Extract WSP from Durian Seeds

Emulsion power is influenced by protein contained in the material. The amount of emulsion power of crude extract WSP from durian seeds on variations long times of the extraction yield of varying value. At the time of extraction of 5, 65 and 125 minutes respectively generate value  $50.37 \text{ m}^2 / \text{g}$ ;  $55.77 \text{ m}^2 / \text{g}$ ; and  $52.26 \text{ m}^2 / \text{g}$ . In the 65-minute treatment increased this because all proteins in the material so that the ability to bind to form a high emulsion. At 125 minutes possible treatment has been denatured protein that decreases the ability as an emulsifier. This emulsion lower power compared to the WSP from *Dioscorea esculenta* is worth  $146.37 \text{ m}^2 / \text{g}$ . Emulsion Power Crude Extract WSP from Durian Seed with long times Variation Extraction can be seen in Figure 6.

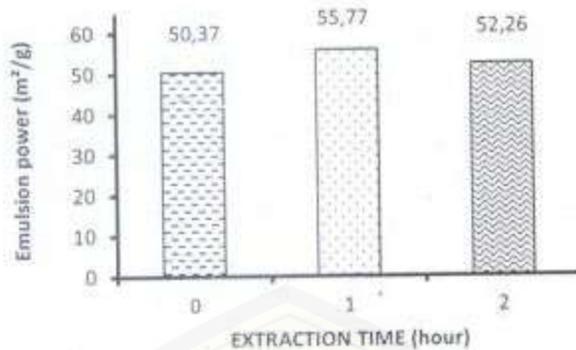


Figure 6. Histogram of Emulsion Power Crude Extract WSP from Durian Seed with long times Variation Extraction

WSP accumulates in the emulsion system (water-oil interface) will increase the protective layer with mechanical stability and sufficient flexibility, the WSP can stabilize emulsions (Sjoblom, 1996). In Figure 7 the results obtained in the extraction time of 5.65 and 125 minutes respectively generate value 327.49 minutes; 244.24 minutes and 142.48 minutes. The longer the extraction time it will lower the surface tension so that the lower the value of the stability of the emulsion. Sumingkrat (1992) stated WSP in small concentrations can reduce the surface tension of the solvent in which the decrease in the surface tension of the emulsion stability can be minimized. This value is lower than the stability of the tuber *Dioscorea esculenta* which has a value of stability of 338.51 minutes.

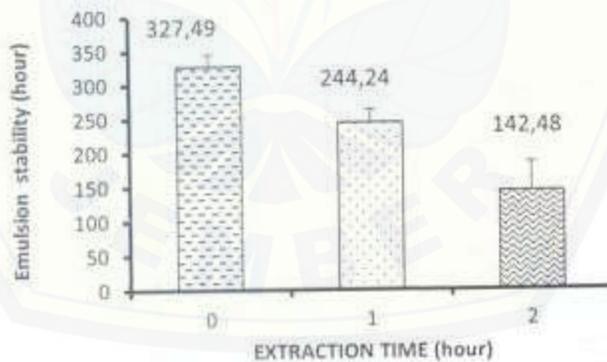


Figure 7. Histogram Emulsion Stability of Crude Extract WSP from Durian Seed with long times Variation Extraction

*Effect of Variation Long Times Extraction to Foam Power and Foam Stability of Crude Extract WSP from Durian Seeds*

Foaming power is the ability of a substance to produce foam, while the foam stability is the ability of a substance to sustain a long time froth or scum that survive. The value of foam power and foam stability of the crude extract WSP durian seeds can be seen in Figure 8 and 9.

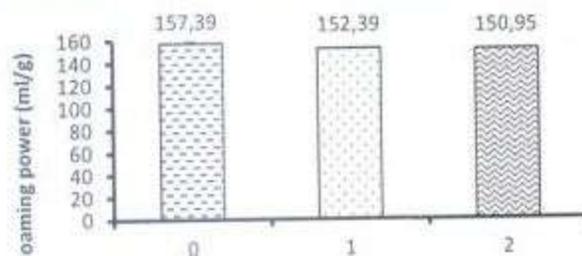


Figure 8. Histogram foam power of Crude Extract WSP from Durian Seed with long times Variation Extraction

From Figure generated foam power value of crude extract WSP from durian seed extraction 5 minutes, 65 minutes, and 125 minutes respectively by 157.39%; 152.39% and 150.95%. The longer the time of extraction causes reduced WSP foam power. This is because it is possible to experience the denaturation of proteins in the material so that the ability to form a foam power to be low so that the foam power decreases.

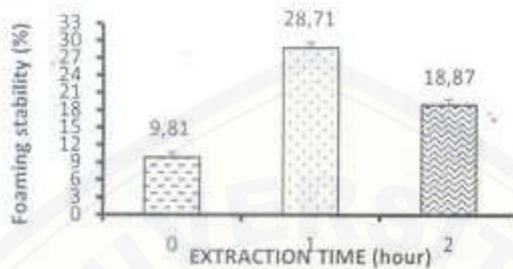


Figure 9. Histogram foam Stability of Crude Extract WSP from Durian Seed with long times Variation Extraction

From Figure 9 shows that the extraction of 65 minutes long treatment provide the greatest stability is 9,81%, while at the time of 5 minutes and 125 minutes respectively 13.14% and 15.72%. The increase is presumably due to the amount of protein in the treatment of 65 minutes has been optimized so that the formation of foam extractable higher than 5 minutes treatment. However, the 125-minute treatment decreased due to the denaturation of the protein so that his ability as a stabilizer decreases. The formation of foam stability of crude extract WSP can be applied to food products such as cake.

### *Effect of variation Long Times Extraction to Lightness of Crude Extract WSP From Durian Seeds*

The observation of the lightness level crude extract WSP from durian seeds are shown in Figure 10.

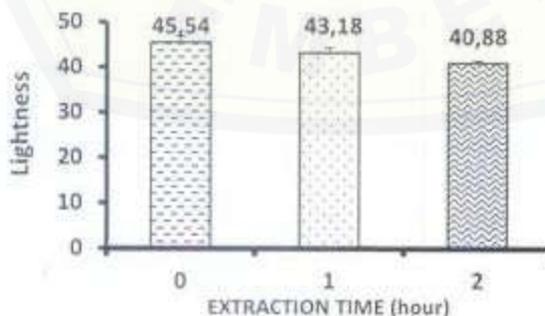


Figure 10 Histogram lightness of Crude Extract WSP from Durian Seed with long times Variation Extraction

From Figure 10 obtained result is highest lihtness value in the treatment of extraction time 5 minutes (45.14), extraction time 65 minutes (43.18) and the extraction of 125 minutes (40.88). The longer the time extraction causing non enzymatic browning reaction because the contact time

between the material with a solvent longer so that the resulting crude extract WSP powder color darker. Besides the dark color of the crude extract powder WSP from durian seeds can also due to the drying process of wet into WSP dry. This is reinforced by Nurdjanah and Usmiati (2006), states that the drying process will trigger a browning reaction to the material. And the presence of reducing sugars and amino acids and heat will cause the reaction to form melanoidin mailard brown.

#### *Effect of Variation Long Times Extraction to Oil Holding Capacity (OHC) of Crude Extract WSP from Durian Seeds*

OHC is influenced by the interaction between the protein-polysaccharide in the WSP. Proteins contained in the bond can not be dissolved in water and but will bind the fat / oil in it. OHC measurements shown in Figure 11.

Figure 11 shows the value OHC different. At 5 minutes long times extraction results obtained 341.16%; extraction time 65 minutes is 361.59% and the extraction of 125 minutes which is 425.36%. The longer the extraction causes WSP retrodegradasi so easily adsorb oil. With this condition, it will increase the value of the OHC of WSP (Boye, 1997). OHC value has a higher value than the WSP from *Dioscorea esculenta*. According Oktafa (2010) WSP from *Dioscorea esculenta* OHC value of 327.33%. Zayas (1997) states that the OHC can affect the textural properties and the quality of other foods. The ability to bind a high fat very good for application in bakery products because it can increase retention of flavor and improve the taste in the mouth.

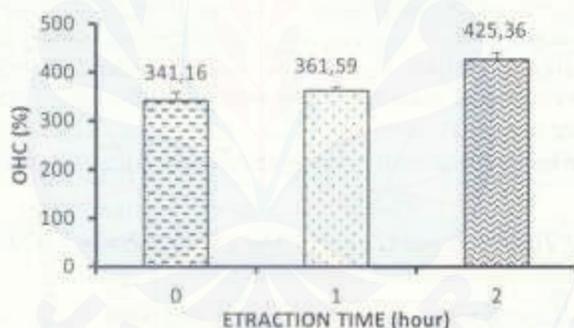


Figure 11. Histogram OHC of Crude Extract WSP from Durian Seed Extracted with long times Variation Extraction

#### *Effect of Variation Long Times Extraction to Water Holding Capacity (WHC) of Crude Extract WSP from Durian Seeds*

WHC is the ability of a substance to absorb water. WHC values of crude extract WSP from durian seeds can be seen in Figure 12.

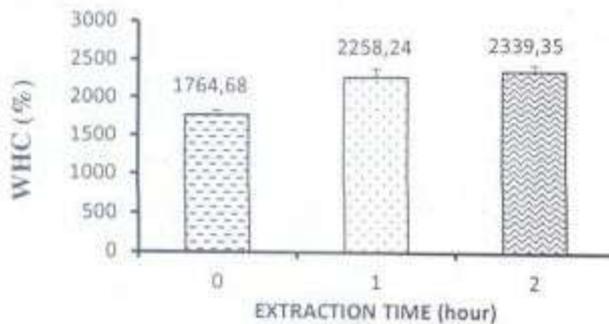


Figure 12. Histogram WHC of Crude Extract WSP from Durian Fruit Seed with long times variation extraction

From Figure 12 shows that different extraction time will yield different values of WHC. Histogram generated WHC fluctuated with the highest WHC results generated in the extraction time 125 minutes that is equal to 2339.35%. WHC value in the treatment of 1764.68% 5 minutes and 65 minutes by 2258.24%. Extraction led to the dissolution of the old coil-coil contained in the molecule WSP, so more and more easily adsorb water. This condition causes the increased WHC values (Adnan, 1997). Value WHC WSP from durian seeds in treatment 65 minutes and 125 minutes have a higher value than the WSP from *Dioscorea esculenta* L. Herlina (2012) stated that the WSP from *Dioscorea esculenta* has a value of 1938% WHC.

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