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The Influence of Waste of Pineapple's Peel (Ananas Comosus (L) Merr) As The Source of Bromelain Enzyme to Increase Meat (Local Beef) Quality

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Abstracts

The subjects of this research are waste of pinepple's peel (*Ananas Comosus (L) Merr*) and local beef that were obtained from Jrakah traditional market, Ngaliyan-Semarang. The data technique analysis of this research is descriptive statistics. The result of this research shows that there is influence of waste of pineapple's peel as source of bromelain enzyme to increase meat quality, especially tenderness. The higher the bromelain enzyme concentration used, the more tender the meat, although will be may increase the score of cooking loss. The meat that is submerged with the highest concentration (40%) of bromelain enzyme solution has score of 0.6662 and 45% of cooking loss. The organoleptic quality identification of meat that is submerged with bromelain enzyme solution, generally is better than the control meat. The meat that is submerged with bromelain enzyme solution gives better appearance, flavor, juiceness, and tenderness than the control meat. © 2015 JNSMR UIN Walisongo. All rights reserved.

Key Word: Pinne Apple's Peel; Waste; Enzyme; Bromelain;, Meat.

1. Introduction

Waste is a public problem that must be coped in this country. As we have known that Indonesia has large amount of citizens. They can produce many kind of waste every day, and cause to increase the volume of waste, both organic and inorganic. Indonesia is a country with a population of up to 225 million produces both organic and inorganic waste every day, almost the same amount for the two kind of waste. The main problem is public awareness and poor waste management. The amount of waste produced each day in

Indonesia reaches 11.330 tons per day and estimated to be 4.0788 million tons per year for the whole country [1]. Waste management is very much needed to decrease amount of waste. Potential waste may be processed to be useful product of higher value as by-product, but non-potential waste can be conditioned in the collecting area in order to be loosed.

Many industries in Indonesia that produce large volumes of wastes, one of them is food industry. Food industry produces large volumes of wastes, both solids and liquid, resulting from the production, preparation and consumption of food. These wastes pose increasing disposal and potential severe pollution problems and represent a loss of valuable biomass and nutrients. Beside their pollution and hazardous aspects, in many cases, food processing wastes might have a potential for conversion into useful products of higher value as by-product, or even as raw material for other industries, or for using as food or feed after biological treatment [2].

Pineapple is an important food which can be eaten fresh or in a processed form. It is composed of nutrients which are good for human health. This is due to researches carried out on the relationship between nutrients in pineapple and human health. Processing pineapple in industries can leave a lot of waste which can cause serious environmental problems [3].

In our country pineapple can be processed to be many kind of foods like cake, jelly and can be processed to be variety beverages too. Mostly of producer is usually just use flesh of pineapple and throw away it's peel. Pineapple is largely consumed around the world as canned pineapple slices, chunk and dice, pineapple juice, fruit salads, sugar syrup, alcohol, citric acid, pineapple chips and pineapple puree. It is also exported to other countries as a fresh product. Sixty percent of fresh pineapple is edible [3].

Whereas peel of pineapple can be used as a meat tenderizer because in the pineapple, both in flesh and peel contain Bromelain enzyme to increase meat quality. In the peel of pineapple contain for about 0.050-0.075 % enzyme bromelain [4]. As Allah SWT stated in sura Ali Imron verse 191 above that Allah SWT create all of both in the sky and in the earth, there are no unuseful [5]. Including on pineapple's peel, although appertain of waste, it is can be used as meat tenderizer. Once the meat is bought, cooked, and served, the aroma, tenderness, juiciness, and flavor must meet the expectations. The aroma and juiciness can be improved using spices and cooking method. However, the tenderness and flavor depend on textural characteristics, composition of meat, and many other factors [6].

In this case, the researcher plans to practice waste management by using recycling methods to decrease waste of food industry, especially waste of pineapple's peel. This recycling will be conducted to identify a potency of pineapple's peel that contain bromelain enzym as meat tenderizer which is one of meat quality decisive factors.

2. Experiments Procedure

Sample preparation

500 grams of fresh beef is sliced into five parts. The weight of each beef is 100 grams. Beef is submerged in bromelain enzyme solution with various concentration (10%, 20%, 30%, 40%) with time control during 90 minutes in the temperature room.

pH measurement

5 grams of sample is pulverized, then put into beaker glass with 10 ml aquades in it. The electroda of pH meter is dipped in to beaker glass. Score of pH can be red from monitor of pH meter.

Water Holding Capacity (WHC) determination

5 grams of sample is pulverized and put into 10 ml sentrifuge tube. Then it is added by 5 ml aquades, mixed, and kept with the temperature of 2-4°C. The next process is sentrifugation up to 20 minutes with the rapidity of 3500 rpm. The liquid is isolated and liquid volume is measured with measuring glass. The WHC determination used Eq.1.

$$WHC = \frac{A - B}{C} \times 100\% \qquad (1)$$

A= volume of water that added (ml)
B= Volume of free water (ml)
C= weight of meat (g)

Cooking loss determination

Samples are weighed before being cooked. Then samples put into heat resistant plastic bag. After that, meats are cooked with the temperature 90^{0}C during 30 minutes. Samples are submerged in the flowing water during 30 minutes. Then samples are kept in the temperature of 1-2 °C a night. Samples are weighed again. The weight has been lost after being cooked are called 'Cooking loss". Cooking loss can be determined Equation 2.

% Cooking loss= $\dfrac{A - B}{A}$ x 100 %   (2)

A= weight of meat before cooking
B= weight of meat after cooking

Tenderness measurement

Tenderness measurement will measure by Universal Testing Machine will be done in the laboratory of technology of Agriculture faculty, Gadjah Mada University Yogyakarta. To support some tests above, researcher will be done organoleptic test including appearance, smell, flavor, tenderness, juiciness, and pleasure.

Techniques of data analysis

The data technique analysis of this research is descriptive statistics. Descriptive statistics is the discipline of quantitatively describing the main features of a collection of data [7]. Descriptive statistics are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures. Together with simple graphics analysis, they form the basis of virtually every quantitative analysis of data [8].

3. Results and Discussion

Pharameter of Meat Specific Test

pH measurement

pH is the measurement of acid or alkaline level of meat. Meat Standard Australia (MSA)

measures the acid level of the meat to ensure eating quality [9]. After livestock has been dead, lactat acid starts to form on meat. It's because the blood stream of livestock is stopped, so the oxygen to the meat is stopped too until the meat can not catch hydrogen ion from glykolysis process [10]. Overplus of hydrogen is used to change pyruvat acid to be lactat acid that causes pH decrease of meat.

In this research, pH measurement was conducted by pH meter. the pH Changing of meat about 5.5 until 5.8. The chart of pH changing is provided in the Figure 1. For control meat is shown with hatching block.
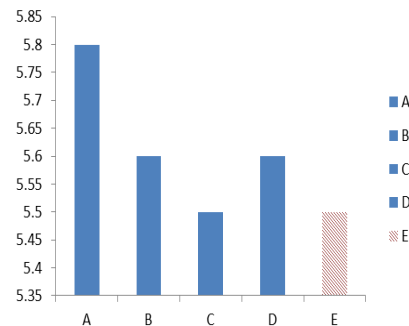

Figure 1. Chart of changing of pH

After measuring with pH meter, the score of meat E is 5.5. For meats that are added with the waste of pineapple's peel solution on blue chart block have score 5.5 until 5.8. As the result of measurement using pH meter, it prooves that adding pineapple's peel solution as the source of bromelain enzyme does not decrease the meat quality, in another word, this meat still in good quality. According to SNI 01 -3948-1995, the good quality requirement of meat is the meat with pH score of about 5.3 – 5.8 [11].

Water Holding Capacity (WHC) determination

The water holding capacity (WHC) of meats is related to the amount of free water released by the meat after physical pressure or force is exerted upon it [12]. Water Holding Capacity (WHC) determination in this research had been conducted with centrifugation method. The sample had been pulverized and put into 10 ml sentifuge tube. Then it was

added by 5 ml aquades and kept with the temperature of 2-4 ºC. The next process was centrifugation up to 20 minutes with the rapidity of 3500 rpm.. The decreasing of WHC can be known with ecsudation liquid that is called "Weep" on unripe meat or "Drip" on frozen unripe meat that is refreshed. Ecsudation comes from the liquid and the fat of meat [13].

The meat that is submerged in pineapple's peel solution has negatif water holding capacity score. It's provided in the Figure 2. The chart is down to beneath with the scores -24%, -26%, -22%,- 20%, and -22%. From the data, the lowest score of water holding capacity on meat B is -26%. In this concentration it's possible for mineral salt has highest content from the others. Whereas the concentration of meat A is higher than meat B. Meat A should has the lowest score of WHC than others.
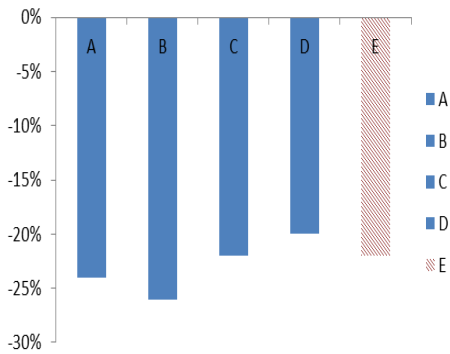

Figure 2. The chart of water holding capacity

Based on the chart above, the meat has no capacity to hold the water when the meat gets treatment from outside. This may occur because the bromelain enzyme from pineapple's peel contains of mineral salt. Callow and Hamm research explained that high ionic power of mineral salt has influence dehydration. Maximum hydration occurs when the ionic power reaches about $0.8 – 1.0$. it's equivalent with 5 -8 % of NaCl for meat with or without the addition of 60% water [14].

Cooking loss determination

Cooking is a process of heating beef at sufficiently high temperatures that denatures proteins and makes it less tough and easy to consume [15]. Cooking loss is one of meat quality parameters. The meat is with lower cooking loss has better quality than the meat with bigger cooking loss, because nutrient that lose is just little during cooking process.

In this research, cooking loss determination was conducted with the meats which were cooked with the temperature 90ºC during 30 minutes. Then samples were submerged in the flowing water during 30 minutes. The process is keeping them in the temperature of 1-2 ºC a night. After that, Samples are weighed. From that treatment, the highest score of cooking loss falls to meat A with the score of 45%. The lowest score is 37% which is fallen to meat E. The meat with the highest score of cooking loss is the meat that was submerged in pineapple's peel solution with the concentration of 40%. And the lowest score is the meat without treatment or control meat. The chart of cooking loss can be seen in Figure 3.
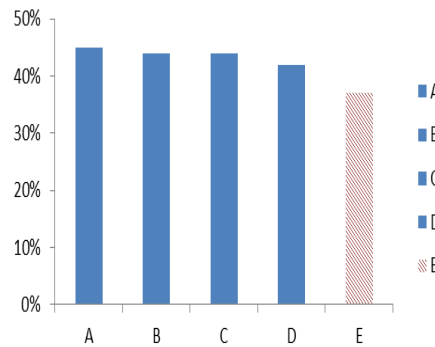

Figure 3. The chart of cooking loss

According to Offer and Knight research, increasing of cooking loss influence the hardness of meat if it's observed from the water factor. Increasing of hardness is related to changing of distribution of water in the meat. But increasing of cooking loss for part of consumers can give profit, because the increasing of cooking loss can decrease the amount of fat in the meat [16].

Tenderness

Tenderness is one of the most determining pharameters of meat quality. The tenderness of meat is detemined by about

three factors. They are structur of myofibilar and contraction status, the content of bond tissue, and water holding capacity of meat protein [17].

The level of tenderness is determined by the amount of protein in bond tissue and myofibrilar. They are colagen protein, actomiosin and elastin. According to Lawrie [18] the older age the livestock is the harder meat the livestock will be have. Protein of meat can be hydrolized by proteolytic enzyme to be simpler compound. The cutting of cross bonding between proteins by proteolytic enzyme causes the tissue of meat more tender when it's consumed [19]. The reaction of proteolytic enzyme can be shown in Figure 4.
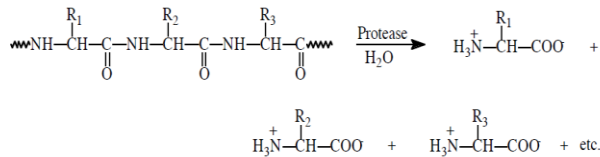

Figure 4. Reaction of proteolytic enzyme.

In this research, the tenderness measurement had been conducted by Universal Testing Machine Zwick/ Z0.5 in the laboratory of technology of Agriculture faculty, Gadjah Mada University Yogyakarta with a laborant named Rachmat on April, 4th 2013.
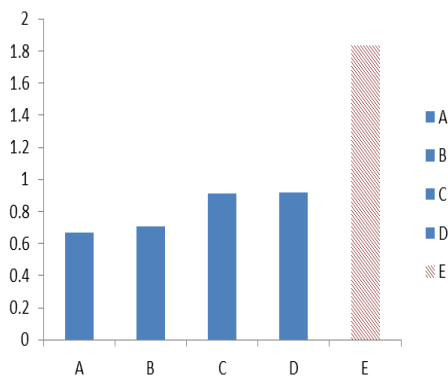

Figure 5. Chart tenderness measurement

It means that the waste of pineapple's peel as the source of bromelain enzyme can influence the tenderness of meat. It prooves that the meat with treatment with pineapple's

peel solution has higher tenderness than meat without treatment (control meat).

Organoleptic Test

Organoleptic testing is generally used to verify the conformity of the seasoning specification. These tests include flavor, taste, texture, aroma, and overal mouthfeel sensation when the product is consumed [20]. In this research, researcher used six specification including appearance, smell, tenderness, flavor, juiceness, and pleasure.

Appearance

The appearance of meat deals with the visual identification of meat quality based on color, marbling, and water holding capacity [21]. Marbling is a small streak of fat that is found within the muscle and can be seen in the meat cut. Marbling has a beneficial effect on juiciness and flavour of meat [22]. In this research, after conducting organoleptic test, the lowest score of appearance is on meat A and meat C with the score of 2.93. It means that on meat A and C with the pineapple's peel solution concentration of 40% and 20% as the source of bromelain enzyme has less coarse appearance after being submerged in that solution. Whereas the hihgest score of appearance is on meat D, 3.40 with the concentration of 10 %. It means based on appraisal of panelist, meat submersion in this research with the 10 % concentration of bromelain enzyme has better appearance than control meat and others.

Smell and Flavor

Another quality factor is smell. The product should have a normal smell. This will be different for each of the species (i.e. beef, pork, chicken), but should vary only slightly within the species. Any rancid or strange smelling meat should be avoided [23].

Smell and flavor of meat are the complex sensation and concerned each other. Smell is main sensation that the most difficult to be defined by objective test. Smell of meat is depended on age, sex, species, fat, and woof of livestock [24]. Based on organoleptic test, the lowest score of smell of meat in this research is meat E (control meat) with the score of 3.07

and the highest score is meat B, it's 3.47. It means the panelis of organoleptic test smells medium until less smelly.

Flavor and aroma are intertwined to create the sensation the consumer has during eating. These perceptions rely on the smell through the nose and on the sensations of salty, sweet, sour and bitter on the tongue. Meat flavour is affected by types of species, diet, cooking method and method of preservation [25]. According to Moncrieff, flavor is used as one of pharameters of organoleptic test, because ti's one of factors of consumer selection [26].The flavor analysis of meat shows that the highest score is on meat D, it's 3.80. The lowest score is on meat B with the score of 2.87. It means that panelist feels that the flavor of meat is medium until flavored.

Tenderness

Tenderness of meat is affected by pre slaughter and post slaughter factors. Pre slaughter factors include species, breed, age, sex, feeding and management, genetic influence and stress conditions. Post slaughter factors that influence meat tenderness include, postmortem glycolysis, postmortem shortening, conditioning, processing and cooking methods [27].

In this research, tenderness of meat is tested by objective and subjective test. For objective test, tenderness of meat is tested by Universal Testing Machine Zwick/ Z0.5 in the laboratory of technology of Agriculture Faculty, Gadjah Mada University Yogyakarta. For subjective test used organoleptic test. The result of this test, meat A with 40% concentration of bromelain enzyme is the most tender than the others, the score is 3.60. The meat with the lowest score is on meat E (control meat), the score is 2.67. Based on objective and subjective, the meat that is sumberged in bromelain enzyme solution can influence the tenderness of meat.

Juiceness

Juiciness depends on the amount of water retained in a cooked meat product. Juiciness increases flavour, helps soften meat - makes it easier to chew, and stimulates saliva production in the mouth. Water retention and lipid content determine juiciness. Marbling and fat around edges help hold in water. Water losses are from evaporation and drip losses [23].

Based on organoleptic test, the appraisal score of juiceness is about very juiceless [1] until very much juiced [5]. The result of this test shows that the score of meat with treatment is 2.67-3.40. it means that the juiceness of meat with treatment is about juicless until juiced. For control meat, the score of juiceness is 2.00. it means that juiceness of the control meat is juiceless.

Pleasure

The pleasure appraisal of panelis for both meat with treatment and meat without treatment (control meat) is very much dislike [1] until very much like [5]. the pleasure of panelist on meat with treatment is 2.93 – 3.67. it means that the pleasure of panelist is about dislike until not very much like. It's not different from control meat, panelist gives appraisal for pleasure with the average score 3.33, it means not very much like.

4. Conclusion

Based on the result of both laboratory test (pH measurement, Water Holding Capacity, Cooking loss, and tenderness) and organoleptic test (appearance, smell, flavor, tenderness, juiciness), it can be concluded that the submersion of meat in the pineapple's peel solution as the source of bromelain enzyme can increase meat quality. The pH of meat after adding pineapple's peel solution still in good quality. The higher bromelain enzyme concentration used, the more tender the meat will be. It means there is increasing quality of meat, because the meat can be more tender. Although this process may increase the score of cooking loss. The meat that was submerged with the highest concentration (40%) of bromelain enzyme solution has the score of 0.6662 and 45% of cooking loss.

The organoleptic quality identification of meat that was submerged with bromelain

enzyme solution, generally was better than control meat, especially on meat D. The meat that was submerged in the bromelain enzyme solution gave better appearance, flavor, juiceness, and tenderness than the control meat.

Acknowledgment

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