THE PHYSICS AND CHEMICAL CHARACTERISTICS OF SAUSAGE CATFISH SUBTITUTION BY ALGAE (*Kappaphycus alvarezii*)

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Abstract

This research was conducted to know the physic and chemical characteristics of sausage catfish substitution by algae (Kappaphycus alvarezii). This research was an experimentally research conducted in laboratory of Agency Analise Agricultural Product Bogor used completely randomized design with repeated two times. The range of concentration substitution Kappaphycus alvarezii used 0% (control), 11%, 15% and 18%. The physics parameters were springiness and cohesiveness, the chemical parameters were protein, fat, water, ash and fiber content. The results showed that treatment of concentration substitution 18 % of Kappaphycus alvarezii can improved phisics characteristics sausage catfish; springiness 3.63 mm and cohesiveness 0.72. The treatment of concentration substitution 15 % of Kappaphycus alvarezii can improved chemical characteristics sausage catfish; protein content 13.59%, fad content 2.97%, water content 60.68%, ash content 0.2%, fiber content 7.83% and carbohydrate content 14.69%.

Keywords: *Sausage catfish, substitution, Kappaphycus alvarezii*

I. INTRODUCTION

Development of Gorontalo Province has potential as a commodity catfish freshwater. The production of catfish as a commodity cultivation in 2013 amounted to 41.95 tonnes (Dinas Perikanan dan Kelautan, 2013). Public interest to consume catfish are very low. This is due to the slippery catfish morphology and head shape so that the width of Gorontalo people assume morphology like a snake . In addition, the old catfish generally large so as not sold alive or fresh , but serve as a parent to death so as not consumed (Siregar et al , 2013) .

According Nurimala et al (2009), catfish has the characteristic appearance of the meat is white with a soft fiber making it suitable as a raw material pulverized fish flesh or surimi (the basic material of fish gel based products one of which is a sausage catfish) . In addition, the catfish has a savory taste and contains 17% protein and 0.95 % low fat. Kappaphycus alvarezii algae is one type of seaweed as raw material for carrageenan and used in foodstuffs because it has the ability to alter the functional properties of the product desired gel properties (Afriwanty , 2008) . K. alvarezii contains some important chemical content of the dietary fiber and iodine are quite high . According Astawan et al (2004), the content of dietary fiber in seaweed K. alvarezii amounted to 78.94 % and amounted to 282.93 mg iodine / g . Acording Dinas Perikanan dan Kelautan (2011) the production of algae K. alvarezii ie 5,228 tonnes in 2011.

The object this research sausage catfish substitution by algae (K.alvarezii). The intent of this study was effect substitution algae (K.alvarezii) toward physic and chemical sausage catfish.

II. MATERIALS AND METHODS

2.1 Materials and equipment

The material for processing of sausages used catfish the size of 600-900 kg / head, bamboo as a sleeve (6 cm long and 1.5 cm in diameter), sugar, ice cubes, corn oil, tapioca starch, seaweed harvesting K. alvarezii 3 month, pepper, garlic, onion, salt (NaCl), red chillies. Curing materiall consists of sawdust, coconut shells and coconut husks. Materials chemical used distilled water, K2SO4, HgO, H2SO4, NaOH 30%, H3B03, indicators methilred, 0.02 N HCl, chloroform, petroleum ether, hexane and ninhydrin.

Equipment used in this study were knives, cutting boards, containers, filter cloth, scales, grinder, food processor, blender, stuffer, pan,

thermometer, a cup of metal, cup porcelain, pestle and mortal, desiccator, oven, analytical balance, an electric heater, Bunsen, steam bath, hot plate, furnace, distillation, burette, funnel, pipette, micropipette, flask 50 mL, 125 mL erlenmeyer, Soxhlet flask, extractor sochlet, texture analizer.

The Processing Sausage Catfish subtitution by algae (K.alvarezii)

The steps processing of sausage catfish substitution by algae (K.alvarezii) were the algae porridge. Digestion of catfih meat and ground spices. Mixing catfish, ground spices and concentration algae porridge 0,11,15 and 18% (L0, L1, L2, L3), charging sleeve, steaming, smoking and analise data.

Data Analyzed

The physics parameters were springiness and cohesiveness, the chemical parameters were water, ash, protein, fat, and fiber content. The measurement springiness and cohesiveness has been done according to the method illustrated by Chen et al (2013). Water content used gravimetric method (ISO 01.2354.2-2006), ash content used gravimetric method (SNI 01-2354.1-2006), protein content used microjeldahl (SNI 01-2354.4-2006), fat content used extraction method sokhlet, crude fiber by Sudarmadji (1997), and carbohydrate content by difference (Winarno, 2002).

2.4. Research Design

The was carried out experimentaly in the laboratory by using a completely randomizes design non factorial. The treatment were concentration substitution K. alvarezii 0, 11, 15 and 18% (control, L1, L2, L3). Each treatment was repeated 2 times, experiment total 8 units. Parameters were observed phisic characteristic(springiness and chohesiveness) and chemical characteristics (water, ash, protein, fat fiber and carbohydrate content). The data were analyzed statistical by ANOVA analysis followed by Duncan's Multiply Range Tes (DMRT) if significantly different.

III. Result and Discussion

3.1 Phisics Characteristics of Sausage Catfish

The physical properties of the sausage catfish c sausage texture will show the quality of the sausage itself because the sausage is a product -based gel (basic gel product). Sausage texture parameter measurements include springiness and cohesiveness. The results of the physical analysis of the texture of sausages catfish can be seen in Figure 1 .

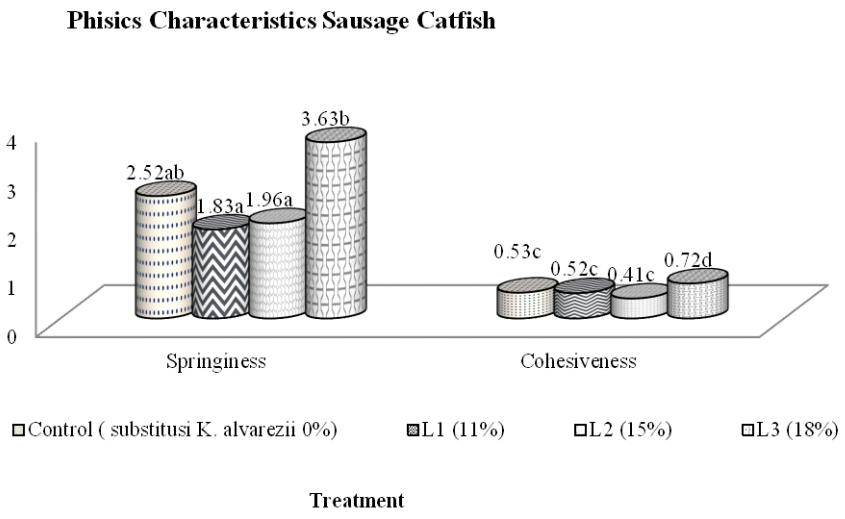

Figure 1. Phisics Characteristic of Sausage Catfish

Based on Figure 1, shows that the average value of springiness lowest for the treatment of L2 is 1.83 mm and the lowest value contained in the treatment cohesiveness L2 is 0.41. The highest springiness value and cohesiveness are on treatment L3 are 3.63 mm and 0.72. Results of

analysis of variance that the substitution K. alvarezii significant effect (P <0.05) against the springiness of sausage catfish. Duncan advanced test distance L3 that the spiringiness treatment (substitution K. alvarezii 18%) was significantly different to the treatment L1 and L2.

Results of analysis of variance that the substitution K. alvarezii significantly affect the value of the cohesiveness of the sausage catfish texture. Duncan analysis that K. alvarezii substitution of 18% was significantly differences to controls, L1 and L2, while among the controls, L1 and L2 undifference.

Differences in the springiness of the sausage catfish value influenced by the amount of starch and pulp K. alvarezii varied. The springiness and cohesiveness of the sausage on the treatment L3 higher than L1 and L2 sausage due to the amount of porridge K. alvarezii 18%.

The springiness and cohesiveness of the texture undifferencse in the control , L1 and L2 treatment.The use of starch alone produces less chewy texture objectively because the lack of ability of the starch to absorb water. Amylopectin starch contained in the group responsible for forming a chewy texture, but on L1 and L2, have been using a mixture of tapioca higher than K. alvarezii. Amount of K. alvarezii indirectly make karageenan against water holding capacity reduced so that the gel formation mechanism sausage sausage reduced so that the springiness and cohesiveness of the texture considered unsignificantly differences in value.

Carrageenan more Water Holding Capacity (WHC) is strong have a high degree of polarity that can form a strong matrix when binds with water, thus indirectly carrageenan will bind water will make the gel becomes stronger (Yulianti, 2003). Carrageenan types kapaa contained in K. alvarezii a jelly that is rigid, hard and brittle compared to iota carrageenan is soft (Santoso and Nugraha, 2008). This research the substitution K. alvarezii high (18%) make the cohesiveness of sausage catfish increase.

3.2 Chemical Characteristic of Sausage Catfish

- Water Content

Knowledge of food product an water content can provide information about freshness , texture and shelf life (quality deterioration) a food products. Results of the analysis of water content catfish substituted sausage by K. alvarezii can be seen in Figure 2.

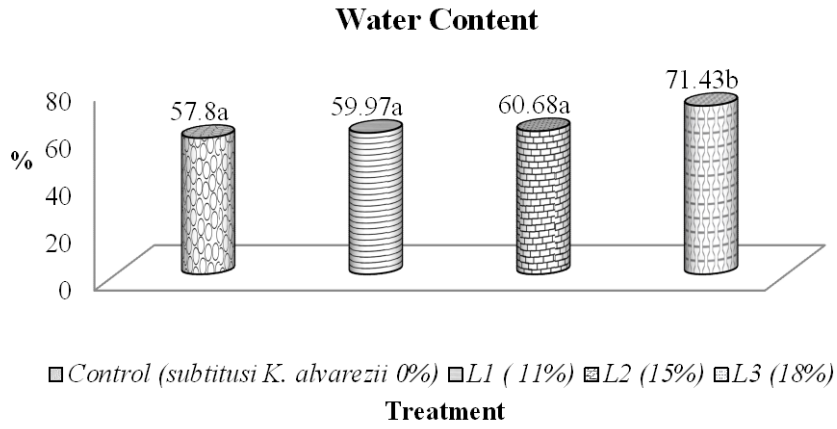

Figure 2. Water content of Sausage Catfish

The water content due to the hydrophilic properties between starch and pulp K.alvarezii. Tapioca flour contains starch granules which can bind with the aid of hot water and then it will turn into a gel. There are two types in the starch fraction of the amylose and amylopectin. Based Figure 2 shows that the average water content ranges from 57.8 to 71.43% with the lowest water content (57.8%) contained in the control sausage and the highest water content (71, 43%) contained in the sausage L3 (substitution K. alvarezii 18%). The higher the substitution amount of tapioca and

K. alvarezii against the increasing water content of sausages. Analysis of variance that the substitution K. alvarezii highly significant effect (P <0.01) on increasing the water content of the sausage.

Duncan advanced test distance that the treatment of the water content of sausages treated L3 differences toward sausages control, L1 and L2 treatment. However, the treatment sausage on L1 and L2 and control are undifferent. Increased improve the ability to bind more water from amylose.

K. alvarezii algae have properties that can bind water because it contains a functional group that is karageenan that acts as hydrocolloid (Afriwanti, 2008). Carrageenan has sulfate groups that can bind water. The content of sulfate groups that are on the negatively charged carrageenan along the polymer chain is hydrophilic and which can bind water or other hydroxyl group (Widodo, 2008).

Based on the ISO 3020-1995 quality sausages, sausages required moisture content is a maximum of 67%, treatment sausage L1, L2 and control, water content qualify levels sausage. But sausage treatment L3 not eligible because the water content based SNI has exceeded the maximum limit 71.43%.

- Ash Content

The data of ash content sausage catfish subtitution by algae (K.alvarezii) can be seen in Figure 3.

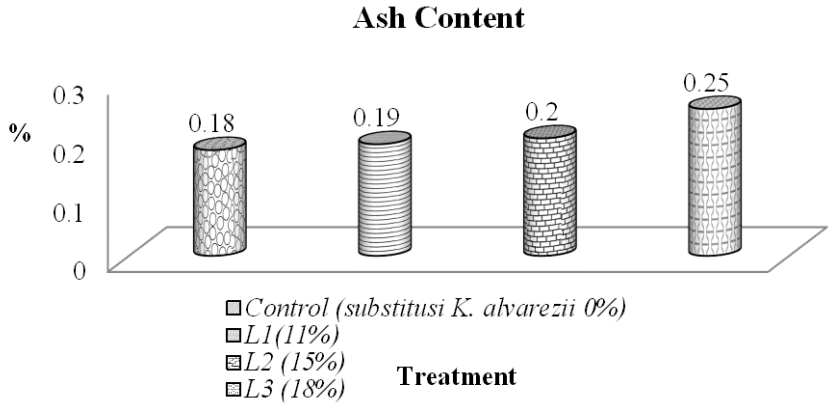

Figure 3. Ash content of Sausage Catfish

Figure 3 shows the average value of ash content ranged sausage between 0.18 to 0.25%. Low ash content values are on the sausage control (without K. alvarezii) ie 0.18% and ash content of the highest catfish sausage L3 treatment (substitution K. alvarezii 18%) which amounted to 0.25%. However, the findings of the analysis of variance that the substitution K. alvarezii unsignificantly affect ash content of sausages catfish.

The discribe of ash content depicting gross inorganic substances in the hearts of food products. Posted prepared food organic material is 96% organic and water, the rest consisting of the mineral elements. Mineral elements inorganic substances known also inorganic or ash content from combustion process, materials organic materials will burned out, while the Inorganic Materials NO, which is called with ash (Winarno, 2002).

All treatments ash content meets the requirements set out ash that posted ISO 3020-1995 maximum of 3%. Low levels of ash caused sausage K. alvarezii used laundering has experienced many times with fresh water so that the ash content reduced. According Vishnu and Rachmawaty (2010), K. alvarezii washing by fresh water produces ash content lower than the 15.13 washing by salty air that produces ash 35% higher.

-Fat Content

Fats in food have diverse functions as a source of energy , contributing to the formation of texture, heat transfer medium and as a solvent in vitamins A, D, E and K. The results of the analysis of fat sausage catfish subtitution K.alvarezii can be seen in Figure 3 .

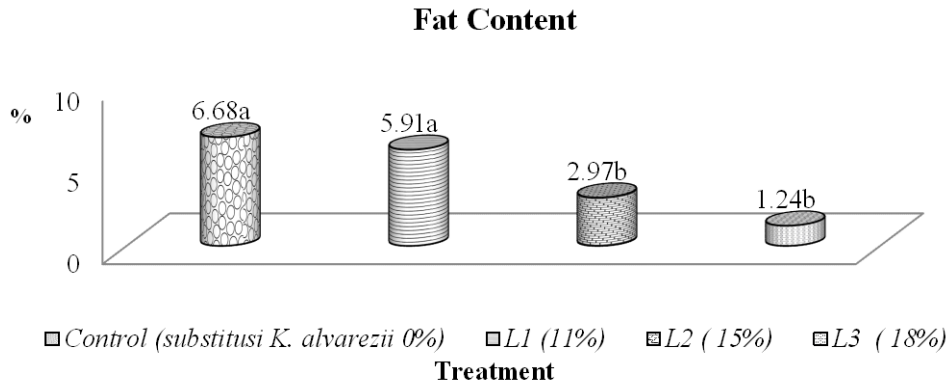

Figure 4. Fat content of Sausage Catfish

Figure 4 shows a decrease in the levels of fat sausage along with increasing concentrations of K. alvarezii substituted on the sausage catfish . The highest fat content found in the control sausage (without K. alvarezii) which is 6.68% and the lowest fat content found in sausages treatment L3 (substitution K. alvarezii 18 %) was 1.24 % .

Analysis of variance that there is a highly significant effect (P <0.01) the substitution K. alvarezii towards decreased levels of fat sausage. Duncan advanced test distance that the fat content of sausage control and L1 (substitution K. alvarezii 11%) highly significant different with sausage fat content L2 and L3 (substitution K. alvarezii 15% and 18%). K. alvarezii substitution of 15% or 18% has been able to lower the amount of fat in sausages significantly. This is because K. alvarezii has the ability to absorb some organic elements like grease. That is because the ability of K. alvarezii fiber. According Marsono (2004), that the fiber-containing foods such as K. alvarezii have organic absorption capability is the ability to absorb some organic matter such as fat and cholesterol. Sausage fat content catfish qualify fat levels set by ISO 3020-1995 which is a maximum of 25%. Fat content in sausages were lower affected by the constituent materials that contain fats such as meat catfish and vegetable oils. Meat catfish fat very low at 0.29% (Nurilmala et al 2008).

-Protein Content

Protein is one of the main important nutrients because the human body needs for growth and for other metabolic functions. Results of the analysis protein content of sausages catfish subtitution K.alvarezii can be seen in Figure 5.

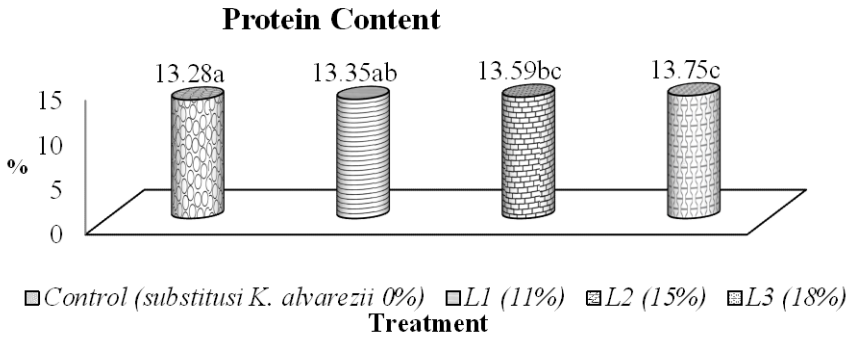

Figure 5. Protein content of Sausage Catfish

Based on Figure 5 shows that the protein value catfish sausages increased with increasing concentrations of K. alvarezii subtitution. The lowest protein content found in the control treatment (without K. alvarezii) 13.28% and the highest protein content found in sausages treatment L3 (substitution K. alvarezii) 13.75%. Results of analysis of variance that the substitution K. alvarezii significant effect (P <0.05) increased levels of the protein. Results within Duncan test that the sausage L3 significantly differences treatment outcomes to the control sausage (without the addition of seaweed) and sausage L1 treatment (substitution K. alvarezii 11%). This is because K. alvarezii also contains proteins which amounted to 5.9% (Astawan et al 2004). Any increase in the concentration of K. alvarezii then an increase in the value of protein statistically sausage catfish.

Research results Widodo (2008) reported that the addition of the sausage karageenan of 0.5% would increase the amount of protein in fish sausage kurisi (Nemipterus nematophorus). The protein content of catfish throughout treatment sausage eligible protein based ISO 3020-1995 that at least 13%. The protein content affected by the component catfish meat, eggs and other protein-containing components. During preparation of the dough sausage or emulsions, meat protein has two functions: 1) emulsifying fat, and 2) a water binder (Kusnandar, 2011).

-Fiber Content

Dietary fiber is a carbohydrate group nonpati , which is prepared on the class of polysaccharides such as pectin , lignin and gums. Foods that have high fiber value is one of the criteria for healthy foods because fiber has many benefits , especially in the human digestive health . Results of the analysis of the fiber in sausages treatment results can be seen in Figure 6 .

Figure 6 shows an increase in the fiber content of sausages catfish line with increasing concentrations of K. alvarezii substitution. Sausage control (without K. alvarezii) contain low fiber content which is 1.29% while the sausage result L3 treatment (substitution K. alvarezii 18%) containing the highest fiber content which 8.83%. However, analysis of variance that unsignificantly effect substitution K. alvarezii to increase fiber content.

The formula sausage catfish used tapioca control 20%, L1 30%, L2 25% and L3 20%. There all any fiber content. So fiber in control treatment from tapioca.

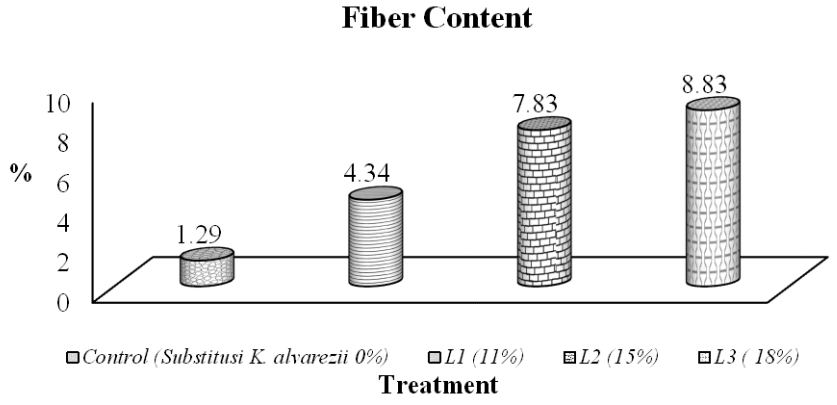

Figure 6. Fiber content of Sausage Catfish

Astawan et al (2004) stated that K. alvarezii very high in fiber which is 78.94%. The recommended fiber intake is 30 g / person / day. Based on the recommended amount of fiber is the amount that can be consumed L3 sausage is a sausage of 400 g / day for the fulfillment of the fiber content. Marsono (2004) describes the functions of the human digestive fibers that are not water-soluble dietary fiber (insoluble fiber) have a nature easily withstand water, causing the stool bulky / expands (bulky) and easily removed. The nature of hail also caused by the increasing age of

bacteria in the feces that is rich in fiber, because fiber food is an excellent substrate for the growth of the microflora in the colon.

-Carbohydrate Content

Carbohydrates are one of the macromolecule that is used as a source of energy for the human body. Carbohydrate analysis results can be seen in Figure 7. Figure 7 shows the average value of carbohydrate decreased in line with increasing concentrations of K. alvarezii substitution. The highest carbohydrate contained in the control is 20.78% and the lowest for the treatment of carbohydrates L3 (substitution K. alvarezii) is 4.58%.

Results of analysis of variance that the substitution K. alvarezii unsignificantly affect the amount of carbohydrates. Because all treatment used tapioca and K.alvarezii for springiness and cohesiveness of sausage. Carbohidrate contributed from both component.

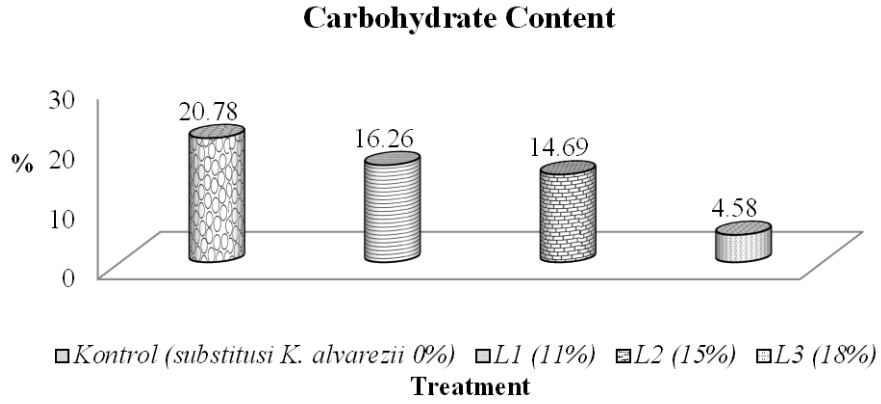

Figure 7. Fiber content of Sausage Catfish

Carbohydrates calculated from the amount of 100 percent of the material components are reduced by the accumulation of other nutritional components, namely water, ash, protein, fat and fiber (Winarno, 2002). Thus that, the value of carbohydrates is influenced by the levels of other nutrients, carbohydrates value decreases due to nutrients such as water, protein, ash and fiber increases. Besides other cause, tapioca as a constituent of sausage is one source of carbohydrate in number decreases with increasing concentrations of K. alvarezii as treatment. Carbohydrate content catfish exception sausage sausage L3 (substitution K. alvarezii 18%) did not meet the carbohydrate levels set by ISO 3020-1995 is a maximum of 8%.

CONCLUSIONS

Based on the results and discussion of research results that have been obtained, it can be conclused:

1. Substitution of K. alvarezii by 18 % (L3) become springiness and cohesiveness better of the sausage catfish.

2. Substitution K. alvarezii results ash, fiber and carbohydrate content unsignificant differences. Subtitution K.alvarezii 15 % (L2) produces good water, fat and protein content of the sausage catfish.

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