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THE CHARACTERISTIC OF PROTEOGLYCANS AS NATURALIZE PRODUCT OF SHRIMP WASTE EXTRACT WITH ION SULFATE ON BROILER

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Abstract

The naturalization process of shrimp waste extract into proteoglycans with different types of binder was an attempt of making material that is expected to provide benefits to increase the productivity of livestock. This new material (proteoglycans) formed through a reaction mechanism that is highly dependent on the origin and additional components that serve as receptors (inhibitory) or activator (trigger) formation/ occurrence of adhesions (chelating) molecule at the core chain. Research has been carried out in the Laboratory of Animal Nutrition Poultry, Non-Ruminant and Feed Industry, and Laboratory of Feed Chemistry Faculty of Animal Husbandry, University of Padjadjaran, Jatinangor-Sumedang. The experimental design used was completely randomized design (6 X 4), with six treatments on chemical and biological extract binding with 3 types of binders on chemical and 3 types binders of biological extraction of shrimp waste, which was repeated four times. Treatment effect was tested statistically by analysis of variance, and differences between treatments were tested by Duncan's Multiple Range Test. The study was done in two stages, namely the stage of preparation (manufacture proteoglycans with the addition of three types of binders sulfate ions), and the stage of biological test. Testing products through value measurement digestibility and hematological of blood broiler. The results showed that the liquid of shrimp waste extraction (either through chemical or biological processes) can be used as a source of manufacture of proteoglycans and as a feed supplement for monogastric. The characteristic of proteoglycans product based of digestibility value with the high quality was occure both chemical and biological extract binding with potassium sulphate; the medium quality Proteoglycans product was chemical and biological processes with ammonium sulfate binder, and with sodium hidrosulphate binder. While less good quality was for chemical extract with sodium hidrosulphate binder. The number of erythrocytes, leukocytes and hematocrit of blood broilers were normaly for all types of products.

Key words: *Shrimp waste, binder, digestibility, hematological, broiler.*

INTRODUCTION

The naturalization process of shrimp waste extract into proteoglycans with different types of binder was an attempt of making material/ material that is expected to provide benefits to increase the productivity of livestock. New material (proteoglycans) formed through a reaction mechanism that is highly dependent on the origin and additional components which will serve as receptors (inhibitory) or activator (trigger) formation or occurrence of adhesions (chelating) molecule at the core chain. In the otherwise the naturalization process of liquid waste once an environmental management efforts or handling of waste which if left untreated can have a negative impact on the environment. This can occur due to denaturation of the protein components or molecules contained in the liquid waste and pollution as a result of the decay process.

Among the fisheries products developed by the government was the development and post-harvest management of shrimp

farming for export. Waste from these activities in the form of shrimp shells. The waste management efforts carried out by using it as raw material for industrial chitosan. Chitosan needed in many industries, such as pharmaceuticals, textiles, and food. With the increasing demand for chitosan, and the rise of industrial manufacture of chitosan, the greater the volume of liquid waste generated from the chitosan extraction process. This chitosan liquid waste extracts rich in dissolved nutrients, including amino-glycans gluko-uronat and acid-forming potential as an ingredient/ constituent proteoglycans. In addition, chitosan liquid waste extract in a state that is not biologically active as it has undergone a process of biological or chemical denaturation. If such things were allowed to happen denaturation sustained negative impact on the environment.

In order to overcome these two efforts naturalize liquid waste of shrimp waste extraction for chitosan by adding a binder which is expected to be a binder nutrients contained in the waste, and perform the polymerization reaction is terminated by the esterification reaction to stop the process/ polymerization reaction. This study aims to find and characterize the products of the process of denaturation (liquid waste) into proteoglycans with binder containing sulfate ions and its influence on digestibility, metabolizable energy, and hematological blood.

MATERIALS AND METHODS

The study was carried out experimentally in the laboratory with the following stages:

1) Preparation of product (scale up) chitosan extract either chemically or biologically.
2) Preparation of proteoglycans extracted chitosan materials, selected products from the best optimization results.
3) Testing of biological products of the three types of binders proteoglycans sulfate ions that have been characterized physically and chemically, through the measurement of dry matter digestibility and protein products of proteoglycans, and blood hematological values in broiler.

$$D = 100\ \% - 100 \left\{ \frac{\%\ IR}{\%\ IF} \ X \ \frac{\%\ NF}{\%\ NR} \right\}$$

(Schneider and Flatt, 1975)

Information:
D = Digestibility; IR = indicators in ration; IF = indicators in feces; NR = nutrien in ration; NF = nutrien in feces.

4) Measured parameters include :
   a) the content of dry matter and crude protein products of proteoglycans (%);
   b) the lignin content of proteoglycans products (%);
   c) the content of dry matter and crude protein feces (%);
   d) the lignin content of feces (%);
   e) the number of erythrocytes (mm/dL);
   f) the number of leukocytes (mm/dL);
   g) hematocrit value (%).

The experimental design used was completely randomized design (6 X 4), with six treatments on chemical and biological extract binding with 3 types of binders on chemical and 3 types binders of biological extraction of shrimp waste, which was repeated four times. Treatment effect was tested statistically by using analysis of variance, and differences between the treatment effect was tested by Duncan's Multiple Range Test.

RESULTS AND DISCUSSIONS

1) Digestibility of Proteoglycans in Broiler

The potential value of nutritional proteoglycans products from shrimp waste

extract can be determined by chemical analysis. The true value of the missing pieces is shown after feedstuffs digested, absorbed and metabolized (Tillman et al., 1991). The results showed that treatment significantly (P<0.05) to the value of the ration digestibility.

Table 1. Digestibility Mean Value Products Proteoglycans in Each Treatment

Treatment	Dry matter digestibility	Protein digestibility
	.....(%).....	
PgKA	66,17 ^{D}	65,38 ^{D}
PgKP	72,30 ^{A}	73,36 ^{A}
PgKS	58,60 ^{E}	56,44 ^{E}
PgBA	66,12 ^{D}	67,35 ^{C}
PgBP	70,38 ^{B}	71,66 ^{B}
PgBS	68,41 ^{C}	67,17 ^{C}

Note: PgKA = Proteoglycans chemical process with ammonium sulfate binder
PgKP = Proteoglycans chemical process with potassium sulfate binder
PgKS = Proteoglycans chemical process with sodium hydro sulphate binder
PgBA = Proteoglycans biological processes with ammonium sulfate binder
PgBP = Proteoglycans biological process with potassium sulfate binder

Table 1 shows that the dry matter digestibility value in the treatment of binder ammonium sulfate ($(NH_4)_2SO_4$) extracted from either chemically or biologically both showed no significant difference (P>0.05), but significantly (P<0.05) more higher compared sodium hydro sulphate binder, and lower than potassium sulfate and sodium hydrosulfate binders of biological extraction. The use of sodium sulfate binder had lowest dry matter digestibility. The protein digestibility values in proteoglycan products with ammonium hidroksisulfat binder types were not significantly (P>0.05) with sodium hidroxisulfat, but significantly (P<0.05) higher compared with the treatment PgKS and PgKA.

Dry matter digestibility in addition to indicate the portion of nutrients in feed that can be ingested. Reid (1973) argues that there are three categories of quality feed ingredients based digestibility level, ie low quality with digestibility values in the range of 50-60%, with the quality being digestibility values in the range of 60-70%, and high quality with digestibility values above 70%. From the results of this study indicate that potassium sulfate proteoglycans of the type, has a high quality in terms of digestibility. This is understandable because the potassium ion (K) absorption and instrumental help maintain osmotic pressure. K ion permeability of the cell membrane also maintains so traffic in and out of nutrients. In the terms of its characteristics as a constituent amino acid, alkaline products tend to be more profitable. This is because many types of amino acids essential, which is alkaline, such as lysine. The fermentation product was generally acidic. Given that the products tend to be alkaline then it will quickly help neutralize a friendly at the gut, which is more profitable.

Use of proteoglycans bioprocess products (from extraction of Chemicals) PgKP protein digestibility values higher than PgBP. Digestibility value differences caused by the differences in the amount of dissolved nutrients while shrimp waste extraction more, so when naturalization, nutrients much more bound with potassium sulphate ions.

Proteoglycans bioprocess products PgKS had lowest digestibility value. According Kompiang and Ilyas (1983) and Wahju (1997), the difference of digestibility values caused by the differences types of

feed will be processed, including its suitability for broiler hydrolyzed by digestive enzymes. The use of sodium sulfate binder hidroxisulfat ions tends to have a lower protein digestibility than ammonium sulphate and potassium sulphate. This is because the pH of the product is lower PgKS proteoglycans (inclined acid) than the other two types of binders. Results of the first year of the study showed that the pH of the end product of proteoglycans from the $NaHSO_4$ binder was 6, while the results naturalization with ammonium sulfate at pH 7 and pH potassium results at 10. Lehninger (1992) studied that an amino acid formed in pH 4 was aspartic and glutamic acid, while the amino acid lysine which was alkaline (pH 10.5), arginine (pH 12.5), cystine (pH 8.4), and tyrosine (pH 10.5). These amino acids alkaline are more essential requirement for monogastric than aspartate and glutamate.

2) Hematological Value

Blood hematological values of broiler were obtained as products of proteoglycans influence can be seen in Table 2.

Table 2. Mean blood hematological Value of Each Treatment

Treatment	Erythrocytes	Leukocytes	Hematocrit
	(x 10^6 /mm^3)	(x 10^3 /mm^3)	.....(%).....
PgKA	2.37 ^{A}	17.56 ^{A}	31.25 ^{AB}
PgKP	2.46 ^{A}	19.29 ^{A}	33.50 A
PgKS	2.12 ^{B}	15.46 ^{A}	27.50 ^{B}
PgBA	2.38 ^{A}	18.15 ^{A}	31.75 ^{A}
PgBP	2.44 A	19.68 ^{A}	33.00 ^{A}
PgBS	2.39 ^{A}	18.44 ^{A}	32.00 ^{A}

Based on Table 2, the average number of erythrocytes in this study were within the normal range (2.12 to 2.46 x 10^6 piece/mm^3). According to Smith (1987) the number of normal erythrocytes in broilers by 2.0 to 3.2 x 10^6 butir/mm^3. Means the broilers were not impaired in their blood due to physiological systems throughout the normal range flats. The number of erythrocytes per mm^3 of blood varies according to species and also between individuals within a species. According to Swenson (1977), the number of erythrocytes is influenced by several factors, including age, sex, diet quality, disease and environmental temperature.

Protein and minerals contained in liquid waste extraction of shrimp waste was easily digested by broilers. Increased digestion and absorption of nutrients will affect the metabolic processes in the body to be smooth. According Anggorodi (1994) that the metabolic processes that will affect the current living cells including blood cells. Anggorodi (1994) starting that the protein can be used to repair damaged cells and tissues in the body, the metabolic process to be smooth and improve growth. With a smooth affect erythrocyte metabolism that has durability with longer life, thereby reducing the number of damaged cells and affect the overall number of erythrocytes.

Leukocyte counts of broilers in this study were within the normal range in the amount of 15.46 to 19.68 x 10^3 butir/mm^3. According to Smith (1987) normal leukocyte count in broilers at 16-40 x 10^3 butir/mm^3. According Frandson (1993), the number of white blood cells is much less than the red blood cells. Brown and Dellman (1989), adding the number of erythrocytes and leukocytes far below vary depending on the type of animal. Fluctuations in the number of leukocytes in each individual fairly large in certain

conditions such as: stress, physiological activity, nutrition, age, and others. Frandson (1993) stated that the increase in the number of leukocytes is generally a sign of infection or injury.

The results of this study illustrate that the product proteoglycans contain enough nutrients for protein and mineral requirements in each treatment so it would affect the number of leukocytes that uniform so as to increase endurance. According to Swenson (1977), leukocytes play a role in strengthening the immune system of various diseases and wound infections. Proteoglycans treatment effect was not significant on the number of leukocytes, means the product can be used as building blocks of animal feed protein sources in broiler chickens. Diet containing enough protein for broilers can affect a performance, health, and endurance. The high hematocrit value is due to the tendency of high red cell count. According to Swenson (1977) hematocrit value has a positive relationship with the number of erythrocytes. Frandson (1993), adding that the hematocrit value is the percentage of blood that consists of red blood cells (erythrocytes).

CONCLUSIONS

The wastewater chitosan extraction from shrimp shells (either through chemical or biological processes) can be used as a source of manufacture of proteoglycans and can be used as a feed supplement in broiler rations. Proteoglycans product quality characteristics of various types of binders with testing blood hematological values and digestibility of broilers was as follows:

a. Digestibility

1. Better quality (value > 70%): Proteoglycans chemical and biological processes with potassium sulfate binder.
2. Medium quality (60-70% value): Proteoglycans chemical and biological processes with ammonium sulfate binder, and the binder Proteoglycans biological process with sodium hydro sulphate.
3. Less good quality (value < 60%): Proteoglycans chemical process with sodium hydro sulphate binders.

b. Hematologic blood

1. The normal amount of blood erythrocytes (range 2.12 to 2.46 x 106 butir/mm^3) for all types of products.
2. Amount of normal blood leukocytes (range 15.46 to 19.68 x 103 butir/mm^3) for all types of products.
3. Abnormal blood hematocrit value (range from 27.50 to 33.50%) for all types of products.

Suggestion

1. Liquid waste from the extraction of chitosan can be utilized in the manufacture of proteoglycans with binders suggested using potassium hidrosulfat.
2. Products of proteoglycans can be used as a feed supplement in broiler rations to increase the absorption of nutrients and maintain the health of livestock.

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