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Study of Bromelain Enzyme Activity on Bromelain Enzyme Production Waste as Feed Additive

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Abstract. This study aimed to know nutrient composition and bromelain enzyme activity of bromelain enzyme production waste as feed additive for animals. The waste sample were analyze by proxymate analyze (nutrient composition) and casein digestion unit method (bromelain enzyme activity). The treatment devided into 2 groups: 1. Sampel dried by sun drying; 2. Sampel dried by oven 60^0C. The nutrient composition of bromelain enzyme production waste is: moisture 9.45%; ash 7.55%; crude protein 5.75%; crude fiber 2.72%; and extract ether 5.64%. Bromelain enzyme activity were do using fresh sample of waste; sample were drying by sun drying method and oven 60^0C. The result showed bromelain activity: 5.14 CDU; 0.08 CDU; and 13.29 CDU. The best preparation process is by drying method using oven at 60^0C which bromelain enzyme activity is 13,29 CDU/mg. It can be concluded that drying process affects the activity of bromelain enzyme.

INTRODUCTION

The price of feed stuff is currently increasing which will have an impact on protein needs of livestock. Various efforts have been made to meet the needs of livestock, one of which is by using feed stuff derived from agricultural waste or agro-industrial waste. The use of these feed stuff is limited to their high crude fiber, low digestibility, and limitations in their use and further processing to reduce the toxins present in the feed. Various efforts have been made to reduce the cost of feed, especially feed protein sources, one of which is by using protease enzymes to increase digestibility. The provision of protease enzymes in feed is expected to increase the protein present in the waste because the type of protein in agricultural waste is a undegrable protein [1]

The availability and price of protease enzymes are problem in the field because it quite expensive and difficult to obtain. Therefore, it is necessary to find alternative sources of enzymes that are easily obtained, one of which is enzymes derived from bromelain enzyme processing waste. The bromelain enzyme has the same activity as the protease enzyme [2]. The bromelain enzyme processing is carried out by PT. Bromelain Enzyme utilizes pineapple steam waste as the main raw material. This waste comes from processing steam pineapple, so it is not utilized and can be used as the main ingredient in the manufacture of bromelain enzymes. The bromelain enzyme processing process still produces waste that is not used anymore, even though on the other hand the rest of the waste is thought to still have good bromelain enzyme activity and can potentially be a feed additive that is easy to obtain and has a low price.

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The high moisture of bromelain enzyme waste is an obstacle to its use [3]. Various simple processing efforts were carried out to determine the enzyme activity, namely by heating the sun and oven at a temperature of 60^0C. The heating process using sunlight itself is a simple drying process because the intensity of the sun in Indonesia is quite high, while the oven process is also carried out to compare the enzyme activities in it. The difference between these 2 methods is expected to be a meeting point in using bromelain enzyme waste as a feed additive.

The personal communication that we obtained with the management of PT. Bromelain Enzyme states that the waste generated in the manufacture of bromelain enzymes reaches 2 tons/day. This condition becomes an obstacle that must be resolved considering that this waste is only disposed of. This research related to the potential of waste both in terms of nutrient content and enzyme activity as a feed additive, the resulting waste can be used as a feed additive for livestock, especially its role in replacing protease enzymes.

MATERIAL AND METHODS

Research material

Samples of bromelain enzyme production waste were obtained from PT. Bromelain Enzyme, Central Lampung, Indonesia. This sample was obtained from filtration after the extraction process in the processing of pineapple cobs into bromelain enzymes.

Chemical

The chemicals used for proximate analysis were distilled water, concentrated H2SO4, 45% NaOH, H3BO3, HCl, chloroform, 0.25N H2SO4, NaOH 0.313N, acetone. The CDU test used an enzyme diluent, casein substrate, TCA, and tyrosine standard.

Sample Preparation

Samples obtained from the production disposal were dried by drying in the sun and drying at a temperature of 600C. Both processes were carried out until the sample was dry and ready to proceed for proximate analyze and enzyme activity.

Research Procedure

This research was conducted using proximate analysis [4] and bromelain enzyme activity test using casein digestion unit analytical method [5]. Proximate analyzes was carried out to determine the moisture, ash, crude fiber, crude protein (NX6.25), and extract ether, while the enzyme activity test was to determine the CDU/mg of the enzyme waste produced.

Data Analyze

The data were analyzed using descriptive analysis to determine the preparation process with the method of heating in the sun dried and oven at 60^0C on nutrient composition and the activity of the bromelain enzyme [6].

RESULT AND DISCUSSION

Result

The research results obtained up to this stage are the results of proximate analysis and enzyme activity of thebromelain enzyme extract waste which are presented in the following table.

TABLE 1. Proximate analyze of bromelain enzyme waste

Description	Percentage (%)
Moisture	9,45
Ash	7,55
Crude protein	5,75
Crude fibre	2,72
Ether extract	5,64

TABLE 2. Bromelain enzyme activity

Sample	Enzyme activity (CDU/mg)
Fresh waste	5,14
Sun-dried	0,08
Dried by oven 60^0C	13,29

Discussion

Proximate analysis of bromelain enzyme extract waste showed that the waste did not have a high macronutrient component. This can be seen from the indicators of feed classification as follows.

1. The ash obtained is 7.55% indicating a low value. The classification of mineral source feed is all feed that has a high mineral content (micro or macro) [7] so this waste is not grouped into mineral source feed.
2. Crude protein content showed a yield of 5.75% which means that this waste also cannot be classified as a protein source feed because the crude protein is less than 20% [7].

The moisture in bromelain enzyme processing waste is high. This is because the waste from agro-industrial processing tends to have a high moisture [8], so it is necessary to handle it to reduce the water content. Grouping based on nutrient content obtained from the proximate analysis showed that bromelain enzyme extract waste was notincluded in the mineral or protein source feed because its value was less than the requirement.

Furthermore, from the results of the enzyme activity analysis, data obtained that the waste has a high enzyme activity, namely 5.14 CDU. This value indicates a high activity rate where the enzyme activity of pineapple waste stems is 3.5 GDU and pineapple fruit is 1.5 GDU [9]. The high enzyme activity obtained is thought to be due to the bromelain enzyme processing process by PT. Bromelain Enzyme uses pineapple stalks as the main ingredient. The results of the study by Varilla *et al*. [10] showed that the enzyme activity was higher in the stalk than in the fruit. This is presumably due to several influencing factors, such as the availability of enzymes, amino acid sequences, and protein conformation.

Data analysis of enzyme activity from drying by drying in the sun and oven at a temperature of 60^0C showed differences in activity. The process of drying with the sun's heat showed a decrease in enzyme activity, while an oven at a temperature of 60^0C could increase enzyme activity. This difference is thought to be because temperature plays a very important role in enzyme activity [11] Temperature plays a very important role in enzyme activity, where every increase in temperature will have an impact on enzyme activity. Gul *et al*. [12] explained that bromelain enzyme activity will be inactive at temperatures above 70^0C. This inactivation process is thought to bedue to the long heating in the drying process which causes unstable heat conditions so that the enzyme begins to degrade and lose its activity [13,14]. The results of the research by Ketnawa *et al.* [15] showed the optimum enzyme activity at a temperature of 50-60^0C and will decrease at temperatures above 60^0C.

Further, condition of the bromelain enzyme tends to be unstable due to the influence of heat. Bromelain also shows high activity even at a temperature of 60^0C because at this temperature bromelain can still maintain its activity. the enzyme degradation process occurs at a temperature of 70^0C or above [15]. An increase in temperature isthought to cause more molecules to have sufficient kinetic energy to react. When the temperature is raised above theoptimal point, the kinetic energy and water molecules will be disturbed, so that enzyme activity will occur. Hale *et al*. [16] also explained that the preparation process greatly influences enzyme activity. The stability of the bromelain enzyme decreased after the preparation process and showed decreased activity after 72 hours of the preparation process.

CONCLUSION

The best preparation process is by drying method using oven at 60^0C which bromelain enzyme activity is 13,29 CDU/mg. It can be concluded that drying process affects the activity of bromelain enzyme.

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