Water activity (WA) and organoleptics physical quality evaluation of complete feed pelleting process for goat with different level water addition

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Abstract

This study aims to determine the differences in organoleptic physical quality and water activity of the complete feed pellet processing process with different levels of hot water addition. The materials used in this research are water, dry corn forage, and concentrates. Concentrates are composed of bran, pollard, cassava, copra, soybean, coffee husk, DDGS, molasses, and Vit-R. The tools needed in this research are pelleter, water heater, chopper, AW meter, and grinder. There were four kinds of treatment, namely the addition of hot water 0% (P0), 20% (P1), 30% (P2), and 40% (P3), respectively. Based on the results of the organoleptic test, it is known that the more water is added, the darker the pellet color, the more compact texture, and the thin sour smell. Based on the water activity test, it was found that the greater the volume of water added, the higher the water activity test results. The addition of different volumes of hot water in the complete feed pellet had a significant effect ($P<0.05$) only on the results of color, smell, and texture. It was concluded that the addition of 40% hot water to the complete feed could produce pellets with the best physical quality.

Keywords: complete feed, organoleptic, pellet, water activity

Introduction

Feed is one of the factors that have a significant impact on livestock productivity, so it is necessary to pay attention to the nutrients needed by livestock. Generally, the problem that often occurs in the field is that livestock often choose the feed given. Things like this are one of the causes of livestock nutrition being unfulfilled, because the feed that should be used to meet one of the nutritional levels of livestock is not consumed. One way to overcome the problems of livestock who like to choose feed is by processing feed into pellets with a simple adhesive so that it is easily applied by breeders. Feed is one of the most important elements in a livestock business, because with the nutrients from this feed, livestock can achieve optimal productivity. Increased livestock productivity can be achieved if the feed provided is sufficient to meet the nutritional needs of livestock [1]. Good feed ingredients for livestock are feed with sufficient nutrient content and have a high palatability value [7].

Organoleptic test is one of the tests used to determine the physical quality of feed. The organoleptic testing method of a material uses the five senses qualitatively (Utama et al., 2020). Organoleptic assessment includes: color, smell, texture and the presence or absence of fungi [9]. Water activity or known as water activity is a test to determine the amount of water in the feed needed by microorganisms to breed. The tool used to measure water activity (WA) is the Aw meter [8]. This device consists of a sensor reader, a sample holder and a disposable sample container [17].

Complete feed is a type of feed that contains sufficient nutrients for livestock at a certain physiological level [2]. Complete feed is considered to be able to meet the nutritional needs of livestock because complete feed already contains various nutrients needed by livestock such as crude protein, fat, energy, minerals, vitamins, and others. One of the feed technologies that can be applied is the manufacture of complete feed [10]. The manufacture of complete feed can be done by mixing until homogeneous various feed ingredients that are considered to have sufficient nutritional value to meet the needs of livestock.

Pellets are one of the results of feed processing technology that changes the mixture of feed ingredients to be more compact so that it is easier for livestock to consume. Pellet feed is processed through a pelleting process which is a pressing process [13]. Heating and high pressure in the pelleting process have proven not to damage the availability of amino acids, nor to the energy benefits of the material [14]. The advantages of using feed in the form of pellets are that it makes it easier to handle, serve feed, and reduce storage space.

Conditioning is an activity of heating feed in the pellet making process that can be done using hot water, during the heating process gelatinization will occur by starch. The melted starch will form into a gelatin which will become an adhesive for the feed ingredients that make up the pellet [11] Through the gelatinization process, there is adhesion between the particles of the constituent materials so that the appearance of the pellet becomes compact, the texture and hardness are good [13].

Materials and Methods

This research was carried out from April to June 2021. This research was carried out at the Padepokan Menda Kencana Seta owned by Mr. Sri Julianto in Kalisidi Village, West Ungaran District, Semarang, Feed Technology Laboratory and Central Laboratory of Diponegoro University, Semarang. The material used in the research consists of tools and materials. The tools used in the pellet making process include mixers, grinder machines, pellet machines, scales, buckets, electric kettles, panelist tables. Materials for making pellets include hot water, dry corn forage, concentrates composed of bran, pollard, cassava, copra, soybeans, coffee husk, cassava, Destillers Dried Grains with Solubles (DDGS), molasses, vit R, Soy Bean Meal (SBM).

Concentrate making

The process of making concentrate is carried out with the help of a mixer, especially by mixing feed ingredients consisting of bran, pollard, cassava, copra, soybean meal, coffee husk, Destillers Dried Grains with Slubles (DDGS), molasses, and vit-R. The manufacture of concentrates must pay attention that the feed ingredients are completely mixed or homogeneous.

Table 1. Concentrate composition

Material	Composition (%)
Bran	20,66
Pollard	24,79
Destillers Dried Grains with Slubles (DDGS)	8,26
Soybean Meal	7,44
Copra	17,22
Cassava	11,57
Coffee Husk	6,61
Molases	4,13
Vit-R	3,31

Source: Multi Nutrient Block Research Data 4, 2021.

Pellet making

The process of making pellets begins with crushing dry corn forage with the help of a grinding machine until the forage is destroyed, after that the grinded dry corn forage will be mixed evenly with the concentrate that has been made with a composition ratio between concentrate and forage of 8:2. After that, the addition of hot water was given with different levels, namely the addition of 20%, 30%, 40%, and the next step was making pellets using a pelleter machine.

Table 2. Pellet composition

Materials	Composition (%)
Concentrate	80
Dry Corn Forage	20
Hot Water	0, 20, 30, 40

Source: Multi Nutrient Block Research Data 4, 2021.

Organoleptic test

The next sample was tested organoleptically by testing the quality of the pellets on several aspects including smell of pellet, color of pellet, texture of pellet, and mushrooms on pellets carried out by semi-trained panelists of 20 people by filling out the form provided.

Table 3. Organoleptic test form

Texture	Smell	Color	Fungus Contamination	Score
Crumb	Concentrated Acid	White	filled with Fungus	1
A little crumb	Smells sour	Pale brown	Many Fungus	2
A little sturdy	Smells a bit	Light brown	Few Fungus	3
Sturdy	No smell	Brown	No Fungus	4

* The lower the score, the lower the quality of the pellet

Water activity (WA) test

The process of making pellets begins with crushing dry corn forage with the help of a grinding machine until the forage is destroyed, after that the grinded dry corn forage will be mixed evenly with the concentrate that has been made with a composition ratio between concentrate and forage of 8:2. After that, the addition of hot water was given with different levels, namely the addition of 20%, 30%, 40%, and the next step was making pellets using a pelleter machine.

Experimental design

The design used in this study was a Completely Randomized Design (CRD) which consisted of 1 factorial with 4 treatments, and 4 replications, and used a pellet unit of 16 units. The treatments that will be carried out in this research include:

P0 : pellets + 0% hot water addition
P1 : pellets + 20% hot water addition
P2 : pellets + 30% hot water addition
P3 : pellets + 40% hot water addition

The data obtained were then analyzed using analysis of variance (ANOVA) at the 5% level. If there is a significant effect, then it is continued with Duncan's Test to determine the difference in the average data.

Results and Discussion

Based on the results of organoleptic tests conducted by panelists and water activity tests, the following averages were obtained:

Table 4. Average of organoleptic and water activity test result

Parameter	Variable				
	Texture	**Odor**	**Color**	**Fungus Contaminations**	**Water Activity**
P0	20 [a]	63 [d]	30,75 [a]	80	0,553 [a]
P1	23,25 [b]	57,75 [c]	48,25 [b]	80	0,7395 [b]
P2	45 [c]	46,35 [ab]	59,5 [c]	80	0,7375 [b]
P3	68 [d]	44,5 [a]	76,25 [d]	80	0,765 [b]

Source: Organoleptic and water activity test result

Based on the results of the research that has been carried out, it shows that the pellet texture of each treatment from P0, P1, P2, and P3 obtained successive results, namely 20; 23.25; 45; and 68, thus showing a significant effect ($P<0.05$). The more water added during the pellet making process will produce a more compact and stronger texture caused by the use of adhesive, namely hot water until the conditioning process occurs. According to [3] that the pellet texture will be influenced by the amount of adhesive added in the feed ingredients to make pellets. The presence of hot water will heat the pellet particles to make the pellet particles stick to each other due to gelatinization.

According to [13] the gelatinization process causes adhesion between the constituent particles so that the appearance of the pellet becomes compact, texture and hardness are good.

Based on the results of the research that has been carried out, it shows that the aroma pellets for each treatment from P0, P1, P2, and P3 obtained successive results, namely 20; 23.25; 45; and 68. Duncan test results show that P0 has a significant effect on P1, P1 has a significant effect on P2, but P2 has no significant effect on P3. Based on these results, it can be seen that the smell of the pellets is influenced by the water content in the pellets. According to [3] that the factor that affects the smell of the pellets is the water content, which if the water content is high in the pellet, it will cause oxidation which triggers a rancid smell in the pellet. Smell has an influence on animal feed consumption so that a good pellet is a pellet that has a distinctive smell, with a brown color, and is not overgrown with fungus. According to [5] that pellets with a brown color that have a distinctive smell without being overgrown with fungus are good pellets.

Based on the results of the research that has been carried out, it shows that the pellet color of each treatment from P0, P1, P2, and P3 obtained successive results, namely 30.75; 48.25; 59.5; and 76.25 so that it shows a significant effect ($P<0.05$). The addition of hot water with increasing amounts is known to make the color of the pellet darker, meaning that the addition of water is a factor that affects the color of the pellet. According to [3] that the more adhesive is added, the darker the pellet color will be. The color of the pellet indicates the quality of the pellet. According to [5] that pellets with a brown color that have a distinctive odor without being overgrown with fungus are good pellets.

Based on the results of the research that has been carried out, it shows that the pellet appearance of each treatment from P0, P1, P2, and P3 obtained successive results, namely 80; 80; 80; and 80 thus indicating that each treatment did not show a significant effect ($P>0.05$). The absence of mold is caused by the fact that after making the pellets, it is aerated and then tested to the panelists without a long storage period so that the pellets are free from mold or fungus and the like so that the high water content has not triggered the growth of fungi. According to [4] that storage will affect the water content in the feed so that it can have an impact on the quality of the feed. Therefore a good pellet is a pellet that has a low water content. According to [8] that the pellet quality will be better if it has a low water content.

Based on the results of the water activity test, it was found that P0, P1, P2, and P3 with successive results of 0.553; 0.7395; 0.7373; 0.765. The results of the analysis of variance are that P0 is significantly different from P1, P2, and P3. While P1, P2, and P3 were not significantly different, which means that the pellet conditions became a place for microbes to easily breed due to the high value of water activity. According to [12] that the result of water activity is 0.7, it means that the high enough content makes the object ideal for microbial growth and biochemical activity. Each test result will determine the level of activity of microorganisms in the pellet. According to [16] that the minimum value of water activity for yeast growth is 0.8-0.9; mold 0.6-0.7; and bacteria 0.9. The value of water activity can increase due

to the metabolism of microorganisms followed by the release of water. According to [15] that water released by the metabolic activity of a microorganism is able to increase the value of water activity. The high value of water activity can accelerate decay, so to deal with this problem, it can be dried or aerated. According to [6] that with drying, the value of water activity in a product will decrease.

Conclusion

Based on the research, it was concluded that the addition of the amount of hot water at the level of 0%, 20%, 30%, 40% in pellet making had a significant effect on texture, color, and smell. However, this study did not have a significant effect on the results of water activity and mushrooms on pellets. The best physical results are found in P4, so to reduce the high levels of water activity it is necessary to dry it first.

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