

# Physical Characteristic and Palatability of Market Vegetable Waste Wafer for Sheep

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**Abstract.** Vegetable waste is a part of vegetables or vegetables that are discarded. This vegetable market wastes are perishable, voluminous (bulky) and the availability was fluctuated so the processing technology is needed to make this vegetable waste become durable, easy to be stored and could be given to the animal. To solve this problem, vegetable waste could be formed into a wafer. The objective of this experiment was to determine the physical characteristic and palatability of vegetable market waste after formed into a wafer. The experimental design used in this research was Completely Randomized Design with 5 treatments and 4 replicates. The treatments were the composition of raw materials used: 100% corn husk (R<sub>1</sub>); 75% corn husk +25% mungbean waste (R<sub>2</sub>); 50% corn husk + 25% mungbean waste + 25% cauliflower leaf (R<sub>3</sub>); 25% corn husk +50% mungbean waste + 25% cauliflower leaf (R<sub>4</sub>); 25% corn husk + 25% mungbean waste +50% cauliflower leaf (R<sub>5</sub>). Variables measured were water activity, water absorption, density and palatability. The results of this research indicated that treatments significantly affected water activity (P<0.08) and wafer palatability (P<0.05). The highly significant difference in water absorption and wafer density (P<0.01) were found among treatments. Based on physical characteristic, R1 had the highest water absorption. R5 had the lowest water activity, whereas R3 had the highest wafer density. Wafer of R<sub>4</sub> was the most palatable for the experimental sheep compare to other treatments.

**Key Words :** physical characteristic, palatability, wafer and vegetable waste

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## Introduction

Development of local farm animal especially sheep need more attention considering its demand which cannot be fulfilled by domestic supply. Constraint that often been met, for example, was low animal productivity as a result of low feed quality, especially during dry season. Therefore, it is urgent to look for alternative source of forage which is cheap, easy to get and available throughout the season. According to Herman (2002), male fat tail sheep have live weight range 33- 49 kg. Their female counterparts weighed 19-49 kg. These sheep produces fewer carcasses with good fat condition.

Vegetable wasted in the market is one alternative of potential feed. The vegetable waste was a problem because it cannot maximally handle in the big cities. Market vegetable waste could be processed to become raw materials of feed for sheep. Some advantages could be obtained from this process such as economic value because it could be

converted into animal feed that is cheap in price, easy to get and does not compete with human needs. Furthermore, this reduces environmental pollution. On the other hand, vegetable wastes are perishable and voluminous (*bulky*). Therefore, easy and cheap processing technology is required to make them more durable, easy to keep and easy to give. Market vegetable wastes utilized in the current study were corn husk, mungbean waste and cauliflower leaf. Corn husk is the external cover of corn which is usually discarded (Umiyasih et al., 2008).

A technology process which is easy, cheap and able to increase feed storage is needed to overcome the feed scarcity in dry season. A Pressing technology can make feed product into a wafer form. The wafer complete feed supplements must contain energy; mineral, vitamin and protein needed by animals to increase productivity. Paradise et al. (2004) stated that cattle kept in a housing system all the time must be given sufficient amount of nutrients to grow and develop. Therefore, the

objective of this experiment was to determine the physical characteristic (water activity, water absorption, wafer density) and palatability of vegetable market waste after they were formed into a wafer given to sheep as a ruminant model.

## Materials and Methods

A total of 15 fat tailed rams with weight of 21-24 kg was used in the palatability study. Vegetable waste (corn husk, mung bean waste and cauliflower leaf) obtained from Pasar Induk Kramat Jati, Jakarta was used to make wafers and molasses was used as adhesive. Bins of vegetable waste, forage chopper, mixer, and plastic bag pressing machine run at a temperature of 150° C, air pressure of 200-300 kg /cm<sup>2</sup>, for 20 minutes were set in the pressing process of wafer formation. The chemical compositions of market vegetable waste were presented in Table 1.

The experimental design used in this research was Completely Randomized Design with 5 treatments and 4 replicates. The treatments were R<sub>1</sub>: corn husk 100%; R<sub>2</sub>: corn husk 75% + mung bean waste 25%; R<sub>3</sub>: corn husk 50% + mung bean waste 25% + Cauliflower leaf 25%; R<sub>4</sub>: corn husk 25% + mung bean waste 50% + Cauliflower leaf 25%; R<sub>5</sub>: corn husk 25% + mung bean waste 25% + Cauliflower leaf 50%.

Data were analyzed using ANOVA and followed by Duncan Test (Steel and Torrie, 1993).

Variables measured were (1). Physical characteristic of vegetable waste wafer included water absorption; water activity and wafer density. (2). The palatability of vegetable waste wafer

## Results and Discussion

### Chemical composition

The nutrient composition of complete fed in the form of wafers made from vegetables waste was presented in Table 2. Based on proximate analysis, the lowest water content (9.42%) was found in wafers contained corn

husk of 25% + mungbean waste of 50% + cauliflower leaf of 25%. The highest water content (20.46%) was found in wafers made from 100% corn husk. The level of water content in wafers was affected by water content of raw materials and relative humidity (RH). Trisyulianti et al. (2003) stated that microorganism activity could be inhibited if water content of wafers was approximately 12%-14%. At this level feed materials will not easily to be mildew and rotten. Verma et al. (1996) found that water content of approximately 8-12% was desirable to get an optimum bounding.

### Water Absorption

Water absorption is the ability of materials to absorb water from the air to bond with material's particle (Jayusmar et al., 2002). The highest water absorption was found in wafers contained 100% corn husk. The lowest water absorption was found in wafers consisted of 25% corn husk + 25% mungbean waste + 50% cauliflower leaf. The highest water content was found in wafer consisted of 100% corn husk. This was because corn husk contain more fibers that have more air cavity to absorb more water. The water absorbing capacity was inversely proportional with density. The higher the density the lower water absorbing capacity will occur.

### Water Activity

Water is an important chemical compound required for life. Water activity is the amount of free water that utilized by microorganisms to grow (Syarif and Halid, 1993). Microorganism can only grow at water activity around 0.70. (Syarif and Halid, 1993). The highest water activity was found in wafer consisted of 50% corn husk + 25% mungbean waste + 25% cauliflower leaf. The lowest water activity was found in wafer contained 25% corn husk + 25% mungbean sprout wastes + 50% cauliflower leaf. But, the difference in water activity of was not significant among treatments. The water activity of wafers could be affected by water content in raw materials or environment temperature where the wafer was stored.

Table 1. Chemical composition of market vegetable waste (% dry matter)

Chemical analysis	Corn husk	Mungbean waste	Cauliflower leaf
Dry matter	22.87	34.63	54.92
Ash	2.80	2.40	11.31
Crude Protein	5.33	21.95	27.57
Crude Fiber	48.19	57.06	18.94
Fat	0.61	0.52	3.50
Beta-N	43.07	18.08	38.69

Chemical analysis of Vegetables wafers from the Laboratory of Science and Feed Technology, Bogor University (2009)

Table 2. Nutrient Composition of Market Vegetable Waste Wafer (% dry matter)

Analysis	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	R <sub>5</sub>
Dry Matter	79,54	89,72	87,80	90,58	86,61
Ash	3,07	2,97	6,97	7,01	9,20
Crude Protein	7,87	8,79	12,69	15,58	18,97
Crude Fiber	35,71	36,25	28,84	31,55	24,88
Fat	0,63	0,66	1,12	0,96	1,01
Beta-N	23,26	41,05	38,18	35,48	32,55

Analysis results from Laboratory of Ilmu dan Teknologi Pakan (2009)

R<sub>1</sub>: 100% corn husk; R<sub>2</sub>: 75% corn husk + 25% mungbean waste; R<sub>3</sub>: 50% corn husk + 25% mungbean waste + 25% cauliflower leaf;

R<sub>4</sub>: 25% corn husk + 50% mungbean waste + 25%; cauliflower leaf R<sub>5</sub>: 25% corn husk + 25% mungbean waste + 50% cauliflower leaf.

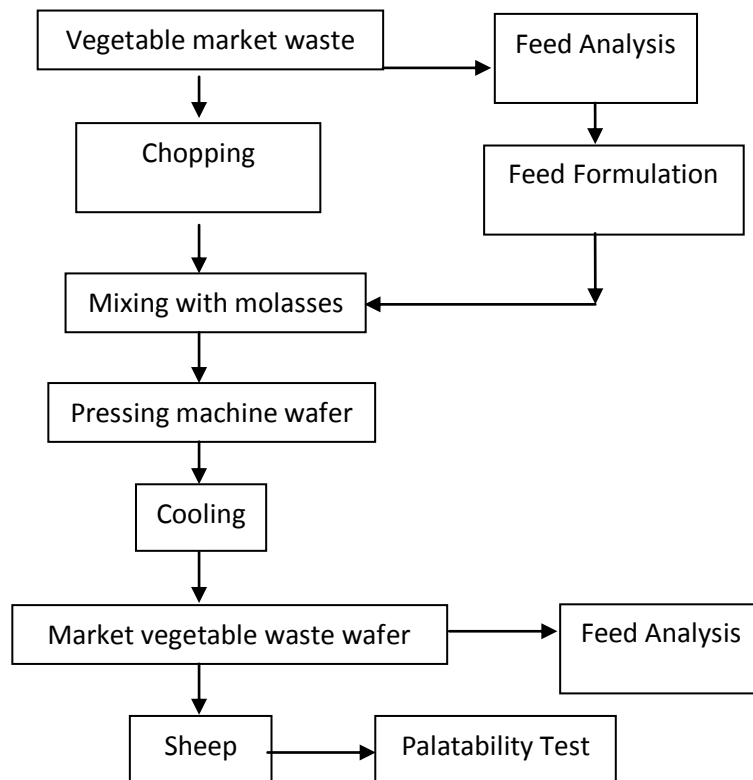


Figure 1. Diagram of vegetable waste wafer processing

Table 3. Physical characteristic of market vegetable waste wafer

Treatments	Variables		
	Water Absorption (%)	Water Activity (%)	Density (g/cm <sup>3</sup> )
R <sub>1</sub>	525.20 ± 12.27 <sup>A</sup>	0.91 ± 0.03 <sup>a</sup>	0.70 ± 0.06 <sup>B</sup>
R <sub>2</sub>	121.35 ± 53.41 <sup>BC</sup>	0.91 ± 0.01 <sup>a</sup>	0.71 ± 0.08 <sup>B</sup>
R <sub>3</sub>	80.79 ± 32.48 <sup>CD</sup>	0.93 ± 0.01 <sup>a</sup>	0.88 ± 0.02 <sup>A</sup>
R <sub>4</sub>	157.53 ± 36.14 <sup>B</sup>	0.91 ± 0.01 <sup>a</sup>	0.56 ± 0.07 <sup>C</sup>
R <sub>5</sub>	42.34 ± 4.86 <sup>D</sup>	0.82 ± 0.11 <sup>b</sup>	0.78 ± 0.07 <sup>B</sup>
Average	185.44	0.89	0.69

Different capital superscripts and small superscripts in the same row significantly different at (P<0.01) and at (P<0.08), respectively.

Table 4. Palatability of market vegetable waste wafer (g/head/hour)

Replications	Treatments				
	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	R <sub>5</sub>
1	14.90	56.60	6.50	58.10	3.50
2	46.10	49.20	44.80	80.50	8.00
3	79.20	34.50	37.90	69.00	5.20
Average	46.73 ± 32.15 <sup>ab</sup>	46.77 ± 11.25 <sup>ab</sup>	29.73 ± 20.41 <sup>bc</sup>	69.27 ± 11.20 <sup>a</sup>	5.57 ± 2.27 <sup>c</sup>

The different small superscripts letter in the same row shows significant (P<0.05)

### Wafer Density

Wafer Density is one important factor in the physical characteristic of wafers that determine wafer strength. The density of feed ingredients rich in fiber has a highly variable value (Toharmat et al., 2006). The lowest density was found in wafer consisted of 100% corn husk and the highest density was found in wafer contained 50% corn husk + 25% mungbean waste + 25% cauliflower leaf. This was because raw materials used to make wafer had variable density. Wafer density determines dimension stability and physical performance of wafer complete ration (Jayusmar et al., 2002). Wafer density was affected by raw material density and pressure given during the process. Wafers having high density will have thick and hard texture, but wafers having low density will have thinner, softer texture and more cavities. Wafer complete ration having high density will have thick and hard texture. This makes them easier to handle for storage and to stack for transportation and more durable in storage (Trisyulianti et al., 2003).

### Palatability

The palatability of feed components could be reflected by the organoleptic such as smell

and taste (salty, sweet, and bitter), texture and temperature that attract livestock to consume (Yusmadi et al., 2008). Palatability is the tastes of raw material or feed affect feed consumption (Scot et al., 1982). The palatability of sugar cane sprout and field grass wafer complete ration were more preferred by FH cows than bagasse or the combination between sprout and bagasse (Retnani et al, 2009). In the current study, the palatability of market vegetable waste wafer was used as indicator to know how fat tail sheep prefer wafer. This palatability test was conducted in one day with wafer supply in one hour.

Table 6 showed that the highest palatability was wafer contained 25% corn husk + 50% mungbean waste + 25% cauliflower leaf. This was because this wafer contain a lot of mungbean waste had small size of particle, so that is easy to be consumed. Besides, this wafer was aromatic. Umiyah et al. (2008) reported that corn leaves and husk have a high palatability. Good wafers have good palatability which is important because it is a result of a combination of factors that animals were stimulated by sight, flavor, contact and taste (Lawrence, 1990).

## Conclusions

Based on the physical characteristic and palatability test in sheep, it could be concluded that wafer containing 25% corn husk + 50% mungbean waste + 25% cauliflower leaf is the best wafers compared with other wafers.

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