Scientific Papers. Series D. Animal Science. Vol. LIX, 2016
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

USE OF ADDITIVES IN DURIAN PEEL SILAGES MAKING

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Abstract

The uses of three additives as sodium chloride, sodium nitrite, and yeast on durian peel silage making were determined. The Completely Randomized Design (CRD) with four replications in each treatment were used in the trial. The silage samples were kept tightly sealed in plastic containers and stored at room temperature for 21 days. The results of physical characteristics, chemical composition and fiber analysis of the durian peel silage were indicated that the color appearance of the durian peel silage was yellowish green for sodium chloride, a green brown color for sodium nitrite, and a red green color for yeast. The aroma of the durian peel silage was aromatic and acidic like pickled fruit. The aroma of the durian peel silage mixed with sodium chloride was sweeter than the durian peel silage from sodium nitrite and yeast. The chemical composition analysis of the non-fermented fresh durian peel for dry matter, protein, fat, fiber, ash, NDF, ADF, ADL, calcium, phosphorus and energy were 92.39%, 6.83% ,0.54% ,33.83% ,4.77% ,42.08% ,51.06% ,7.04% ,0.15%, 0.19%,and 3,843.85 kcal/kg, respectively. The durian peel silage made with sodium chloride, sodium nitrite, and yeast was highly significantly different in dry matter, fiber, ash, NDF, ADF, ADL and energy ($P<0.01$). However, protein, fat, calcium and phosphorus were not significant differences among treatments. Durian peel silage treated with $NaCL_2$ was the highest potential to degrade NDF, ADF, and ADL, respectively.

Key words: *durian peel, silage, additive.*

INTRODUCTION

Durian is one of the economic fruits of Thailand. This product is mostly used for fresh fruit consumption and processing products within the country and exported in terms of fresh fruits and frozen fruits. There are large amounts of durian peels which are left out from fresh fruit consumption and processing products such as durian chips. Thus the manufacturer and municipality must dispose of this large amount of durian peel' waste to alleviate this problem for a green environment. Now they try to make a value added aspect of durians and their by-products. Also, the use of durian peels contribute to useful material for the industrial sector such as packaging, paper pulp, insulator, combustible material, etc.

The chemical composition of durian peel is high in fiber which makes it is a good source of fiber for ruminant feed (Sorada et al., 2010).

Durian peel could be used as ruminant feed in silage forms to preserves the quality of its nutrient. Furthermore, it can be kept for a long time.

Durian peel silage can alleviate a mal-nutrition in ruminants during dry season or flooding time. It is a high quality silage because it is good in digestibility and palatability. It is easy for animal raisers to make durian peel silage for their animals by themselves.

This can help reduces animal feed cost and increase the quality of feed which is reflected in the high production performance of their animal. However, the quality of silage is depends on feed additive uses during making processes.

This research is aimed at selecting the suitable additives to apply to durian peel silage making for ruminant feed.

MATERIALS AND METHODS

Silage preparation

Durian peel was randomly taken from the durian products industry and chopped into 2-3 cm./pieces. The pre-silage material samples were mixed with three difference additives as; 1% $NaCl_2$, Sodium nitrate, and yeast. All samples were put in polyethylene bags and stored at ambient temperature for 21 days.

After 21 days of fermentation, a total of 25 g of each sample was dissolved in 100 ml of sterile water and stirred for 10 min. The pH values were measured for acidity changes by the pH meter (Polan et al., 1998). The silages color and aroma were described according to the indices score of Muhammad et al. (2008). For the color description, the silages were scored as 1 = dark or deep brown, 2 = light brown, 3 = pale yellow, and 4 = yellowish green. For the aroma description, the silages were scored as 1= putrid or rancid, 2 = pleasant, 3 = sweet, and 4 = very sweet.

Proximate analysis of silage

The 1,000 g of durian peel sample was randomly collected to determine the nutrient composition. The samples were oven dried at 60°C for 48 h. prior to proximate analysis. Dry matter (DM), ash, crude protein (CP), crude fiber (CF), ether extract (EE), nitrogen free extract (NFE) and organic matter (OM) were determined according to the methods of AOAC (1995). Neutral detergent fiber (NDF) and Acid detergent fiber (ADF) were determined according to the method of Van Soest and Robertson (1979). Proximate analysis was done two times as before and after fermentation. The experiments were repeated in three times.

RESULTS AND DISCUSSIONS

Physical characteristic of durian peel silage

After 21 days of fermentation, the polyethylene bag was opened and evaluated for gross characteristic as follows;

Color of durian peel silage

Durian peel silage mixed with 1% $NaCL_2$ had an olive yellow color which this shows a good characteristic of silage (Muhammad et al. 2008). For the durian peel mixed with $NaNO_3$ there was a dark brown color, and green red color for the durian peel that was mixed with yeast. Generally, the silage should have a darker color than fresh forage because the color of chlorophyll reacted with acid from fermentation. These changed them to become a magnesium free pigment phaeophytin. However, the carotene was a provitamin A which was suffered from oxidation at high temperature (Azim et al., 2000).

Smell of durian peel silage

Durian peel silage mixed with $NaCl_2$, $NaNO_3$, and yeast had a good smell like the pickled fruit. This smell was very aromatic and acidic for good silage (Merry et al., 2000). The sweet smell was caused by lactic acid bacteria which utilized sugar in the forage to produce lactic acid and volatile acid (McDonald et al., 1991).

General characteristic of durian peel silage

After 21 days of fermentation, the polyethylene bag was opened. The durian peel silage was a little subsided and fungi was found dispersed in the silage that was mixed with $NaNO_3$, and yeast. It occurred when the durian peel was compacted. Then, oxygen still remained in the polyethylene bag and it caused fungi to grow (Merry et al., 2000). However, the durian peel silage that was mixed with $NaCl_2$ was clear with non fungi occurring in the polyethylene bag.

A B C D

Fig. 1. Characteristic of durian peel before and after fermentation
A = Before fermentation, B = Mixed with $NaCL_2$, C = Mixed with $NaNO_3$, and D = Mixed with yeast

Chemical composition of durian peel

The chemical composition of fresh durian peel revealed that DM, CP, EE, CF, Ash, Ca, P Energy, NDF, ADF and ADL were 93.39%, 7.39%, 0.59%, 36.62%, 5.17%, 0.21%, 4,160 kcal/kg, 55.27%, 45.54%, and 7.62%, respecttively (Table 1). These data was similar to Sorada et al. (2010) reported that the chemical composition of durian peel Montong variety were CP = 5.48%, EE = 0.82% and Ash = 3.58%.

Table 1. Nutrition value of fresh durian peel (%)

DM	CP	EE	CF	Ash	Ca	P	Energy (kcal/kg)	NDF	ADF	ADL
92.39	7.39	0.59	36.62	5.17	0.17	0.21	4,160.63	55.27	45.54	7.62

Changes in chemical composition of durian peel silage

The nutritive value of durian peel silage that mixed with $NaCl_2$, $NaNO_3$, and yeast was indicated in Table 2. The dry matter was changed before and after fermentation from 92.39% to 87.7%, 88.65%, and 90.47% for $NaCL_2$, $NaNO_3$, and yeast, respectively.

Durian peel treated with yeast was highly significant in dry matter than $NaCL_2$, but it was not significantly different with $NaNO_3$. The dry matter of durian peel silage that was treated with three kinds of additives was decreased when compared with fresh durian peel. This may have happened because the microorganism utilized carbohydrate in durian peel for their energy source to grow up and increased the number of bacteria (Suradej, 2005).

Durian peel silage treated with $NaNO_3$ was higher in protein (8.28%) than yeast (7.53%) and $NaCl_2$ (7.28%) but there were not significantly differences ($P>0.05$).

McDonald et al. (1991) reported that usually decreases in protein was due to the initially digestion by microorganism, while the increased of protein may occurs by the influence of salt, which it prevents *Clostridium* sp. to not destroy protein. There were not significantly differences in protein, ether extract, calcium, and phosphorus.

Durian peel silage were increased in fat before and after fermentation from 0.59% to 0.79%, 0.96%, and 0.77% for $NaCL_2$, $NaNO_3$, and yeast, respectively. However, there were not significantly differences among treatment ($P>0.05$). Fat had a little relation with fermentation processed, the increased of fat came from a cell wall released by anaerobic bacteria digestion (Suradej, 2005).

Durian peel treated with $NaNO_3$ was significantly lower in fiber (29.08%) than $Nacl_2$ (31.42%), and yeast (35.57%). However, there were not significantly differences between $NaNO_3$ and yeast. During fermentation, a decrease of fiber may have occurred by the digestion of *Lactobacillus* sp. to the cell wall which was the part of the fiber (Suradej, 2005; Sranya and Cnantakan, 1997; McDonald et al., 1991).

Durian peel silage treated with $NaCL_2$ was highly significant in ash (10.49%) than $NaNO_3$ (6.22%) and yeast (7.33%). There were not significantly differences between $NaNO_3$ and yeast. The increased of ash occurred by the utilization of plant organic substance and change to inorganic substance by microorganism during fermentation (Frame, 1994).

The energy of durian peel silage treated with $NaCL_2$, $NaNO_3$, and yeast were 3,979.21, 4,206.78, and 4,125.50 kcal/kg, respectively.

The fiber analysis revealed that $NaCL_2$ was highly significant degraded of NDF, ADF, and ADL (Table 3). Durian peel silage treated with $NaCL_2$ was significantly lower in NDF (50.19%) than yeast (61.96%). There were not significant differences in NDF percentages between $NaCL_2$ (50.19%) and $NaNO_3$ (51.06%). NDF was a part of the cell wall and carbohydrate structure of plants. It was utilized by microorganisms for their energy sources during fermentation, especially anaerobic microorganism. Furthermore, hemicellulose was hydrolysis by plant enzyme as a source of nutrient such as pentose (O'Kiely and Muck, 1998). Bustos et al. (2005) reported that when glucose was deficient, the *Lactobacillus pentosus* could produces acetic acid and lactic acid by using pentose from hemicellulose. The increase of NDF may occur by microorganisms utilizing sugar in plant cell for their growth and activity (Campbell and Smith, 1991).

The durian peel silage treated with $NaCL_2$ was significances lower in ADF (39.60%) than $NaNO_3$ (41.24%) and yeast (48.34%). There were not significantly differences between $NaCL_2$ and $NaNO_3$. Generally, a good range of ADF in dairy cattle' feed should be around 40 – 60 % to produces butterfat in milk (Somjit, 2006).

Durian peel silage treated with $NaCL_2$ was significantly lower in ADL (6.58%) than $NaNO_3$ (8.61%) and yeast (8.67%). There were not significantly differences between $NaNO_3$ and yeast.

The quantity of lignin, cellulose, and hemicellulose in feed are important for the forage crop of ruminants. A good quality of forage crop should be low in lignin (Flores, 1991).

Table 2.The Nutritive value of durian peel silage.[1/]

Treatment	DM	CP	EE	CF	Ash	Ca	P	Energy
1. $NaCL_2$ 1%	87.74[b]	7.28	0.79	31.42[ab]	10.49[a]	0.22	0.15	3979.21[b]
2. $NaNO_3$	88.65[ab]	8.28	0.96	29.80[b]	6.22[b]	0.45	0.16	4206.78[a]
3. Yest	90.47[a]	7.53	0.77	35.57[a]	7.33[b]	0.22	0.12	4125.50[ab]
CV. (%)	1.06	8.99	27.36	7.42	16.41	71.69	39.09	1.71

[1/]Mean followed by differences letter in each column are highly significantly differences (P<0.01)

Table 3. Fiber composition of durian peel.[1/]

Treatment	NDF	ADF	ADL
.1NaCl 1 %	50.19[b]	39.60[b]	6.58[b]
2.$NaNO_3$	51.06[b]	41.24[b]	8.61[a]
3.Yest	61.96[a]	48.34[a]	8.67[a]
CV. (%)	4.36	5.16	7.84

[1/]Mean followed by differences letter in each column are highly significant differences (P<0.01)

CONCLUSIONS

Durian peel silage treated with NaCL2 may develops a biological feed for ruminant in Thailand. It was rapidly degraded of fiber within 21 days. It was the highest potential to degrade NDF, ADF, and ADL, respectively.

ACKNOWLEDGEMENTS

The authors are thankful to Faculty of Agricultural Technology King Mongkut's Institute of Technology Ladkrabang Bangkok Thailand for partly financial support.

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