ALTERNATIVE LIVESTOCK FEED FROM FERMENTED BANANA PEEL

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Abstract

Silage is one of the preservation methods for animal feed during periods of feed shortages by fermentation method. It has a potential to be an alternative livestock feed resources such as cattle and goat. The silage prepared from banana peel is suitable since banana is one of the native plants in Malaysia. This study is aimed to prepare an alternative livestock feed from banana peel which was obtained around Kuala Pilah area, Negeri Sembilan was ensiled in two different drums for 21 days. Samples from each drum were taken for analysis of physical observation (odour and colour), dry matter (DM), and ash contents. Other parameters such as the temperature, pH value, volatile fatty acid (VFA), and water soluble carbohydrates (WSC) were also being conducted. Results obtained show the colour of silage was light green and the odour was mild and sour milk smell. For pH analysis which was measured after the ensiling process, was obtained at 3.96. The low pH value shows high-quality fermentation ranged from 3.5 - 4.5. The DM and ash contents were 45.67 % and 5.21 % respectively as these value were compatible for livestock feed. In conclusion, ensiling by-product like banana peel has good potential as it simple, low-cost and also produces a high-quality feed to livestock.

Keywords: *Silage, Dry Matter, Ash Content, pH, and Water Soluble Carbohydrates.*

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1. Introduction

Banana is categorized as a standout amongst the most well-known natural products in the world business sector (Meechaona *et al.*, 2007). It leads to the variety Musa from the family *Musaceae* (Ooi *et al*., 2011). In the beginning, banana is found in the area of Southeast Asia, yet now it can be found all around the globe. It arrives in an assortment of sizes, shapes, and shading as there are numerous cross breeds that can be found in Malaysia. Some of the cross breeds that can be found in Malaysia are Berangan banana, Awak banana, Saba banana, Rastali banana and Horn banana. Banana itself has groups of parts incorporates organic products, blossoms, leaves, trunks, and peels. Since banana is easily ruined, a pair of experts had realized the potential of switching over a banana peel into cattle feedstuff. As the products of the banana trees are consumed in green, normal ready and ready stages (Emaga *et al*., 2007). Before being utilized, the bananas are normally peeled and the peel will then be disposed of, given to cattle or cooked, or fermented (Bakry *et al*., 1997).

Banana peel has potential as low-cost feedstuff for cattle. Banana is high altogether dietary fibre content, particularly in hemicelluloses. Other than dietary fibre, it additionally contains

high measures of crucial minerals, for example, potassium and sodium. It also contains various types of vitamins, for example, A, B1, B2, and C. Developed green banana is extremely rich in harmless starch, which is impervious to α-amylase and gluco-amylase because of its high level of crystalline characteristic structure (Zhang *et al*., 2005).

Ruminants like cattle are typically consumed next to no glucose from their food. In any case, glucose supply is still fundamental for upkeep and beneficial capacities in ruminants, for example, developing and lactating dairy cattle (Reynolds, 2005). A lactating dairy cow needs a good supply of glucose due to the demands of milk synthesis for glucose. It was practical to produce animal ensiled feedstuff by utilizing banana peel which has been discarded or dismissals which will advantage the small cattle farmers or rural cattle farmers. In markets, there are abundant of selection of feed resources for feeding cattle. Nonetheless, there is a gap between demand and quantity of conventional feed resources for feeding cattle in the world. (Dikshit and Birthal, 2010).

For small-scale and rural farmers, the high-grade conventional feed resources such as Napier grass, pallets, and wheat straw is quite expensive to get (Dikshit and Birthal, 2010) and also less available in Malaysia. In spite of this problem, it is necessary to increase the availability of alternative feed resources for cattle (Amata, 2014). Therefore, producing feed resources from ensiled banana peels that contained the nutritional value requirement like glucose is important as alternative feed resources, especially for resolving feed resources demand also, will ease small-scale and rural farmers' burden.

2. Materials and methods

The Banana peels were obtained from local banana fritter's seller and local market in Kuala Pilah area. After that, the banana was ensiled in two 120 kg plastic drums with the air-tightened cap. Before covering with air-tightened cap, the temperature of the material was recorded. The material was ensiled for a period of 28 days. (Hansson, 2012).

2.1 Chemical Analysis

Chemical characterization plays an important role in guiding toward a good quality silage production. In this section, analysis of silage by an instrument like UV Spectrophotometer, and Fourier Transform Infra-Red (FT-IR) will be further discussed based on the previous study (Hill Laboratories, n.d. ; Nielsen, 2010 ; Ward, 2011).

2.2 Physical Analysis

Under physical characterization, there is some parameter that can be used as guidelines or references to show how well silage is being fermented by physically or appearance (Babayemi, 2009 ; Falola *et al*., 2013). The examples are colour and odour of the fermented silage.

2.2.1 Dry Matter (DM) analysis

Silage sample was weighed and put into pre-weighed and preheated aluminium dish. After that, the crucible was put in an oven at 103 °C ± 2 °C for two hours. The mass of

aluminium dish with DM was weighed after being cooled down to room temperature to nearest weight.

2.2.2 Water Soluble Carbohydrates (WSC) analysis

1 ml of filtered silage was added with 5 ml of concentrated H_2SO_4 and 50 µL of phenol respectively in the test tube. All the test tubes were placed in the fume hood for one hour. Then, the absorbance was measured with cuvette cell with a maximum wavelength at 490 nm with UV spectrophotometer (DuBois *et al.,* 1956).

2.2.3 pH analysis

20 g of freshly chopped silage were weighed out with an analytical balance. Then, 100 ml of deionized water was added. After that, it was blended with industrial blender for 30 s. It was filtered through cheesecloth and stored in a screwed cap bottle. After allowing the sample to stand for 30 minutes at room temperature, the electrode was placed into the silage solution and read the pH to two decimal places after allowing the pH meter to equilibrate for 30 s.

2.2.4 Fourier Transform Infra-Red (FT-IR) analysis

100 g of silage was weighed in a 1 L beaker and the distilled water was added up to the mark as shown in Figure 3.3. After that, the silage was let to soak for 16 hours (overnight) in a refrigerator (2 °C – 8 °C). The aliquot of silage was filtered through a filter paper. After that, the aliquot was run on FT-IR instrument

3. Results and discussions

3.1 Physical analysis

Colour and odour were the easiest to know how well silages were fermented. By using physical appearances and characterization, the quality of silage can easily determine. Referring to Table 1, the odour of banana peel silage (BPS) that had been determined in this study was a mild, natural yoghurt smell. This odour was desirable for a good quality silage characteristic. Good quality silage either legume, grass, corn or natural by-product like banana peel should have a pleasant smell. According to Mannetje (1999), when the original colour of the meadow or feed is well preserved, it displays that a good quality silages. Throughout this study, the colour appearance of BPS was light green near to brownish green.

Table 1. Physical analysis result

Type of physical analysis	Results
Odour	A mild, natural yoghurt smell
Colour	Light green near to brownish green

3.2 DM analysis

The result obtained of DM analysis was 45.67 % of DM in the silage hence, the total moisture content in the silage was 54.33 %. This high moisture content in BPS because

it has came from the fresh pasture like cassava, banana, and grass. Determination of the DM content in BPS of feed provides the amount of a particular feed that was required to supply a set amount of nutrients to the ruminants. Increasing or decreasing in feed DM content may resulted in over or under feeding of nutrients.

3.3 Ash analysis

Ash content was one of the important parameters to good quality silage. Ash can be determined as total mineral content in the forage or feed stuff. It was remained in the ash of the burned feed stuff at high temperature to remove any volatile organic compounds (VOC). The ash content of BPS studied was 5.21 %. As the BPS data on ash content were not available in any literature review, it was compared to corn silage's ash content. According to Hoffman (2005), the normal ash content for corn silage was approximately 5 % to 10 %. Table 2 summarize the result of DM and ash analysis.

Table 2. DM and Ash Analysis

Type of analysis	Results
Dry Matter (DM)	45.67%
Ash	5.21%

3.4 Water Soluble Carbohydrates (WSC) Analysis

Based on the standard calibration curve (Figure 1.) that already made from stock glucose, comparison of the data can be made up to obtain the concentration of the glucose in BPS. Five samples of BPS were run by UV – VIS spectrophotometer instrument and the mean absorbance of these BPS's sample was 3.66. By comparison with standard calibration curve, the concentration of the glucose in the BPS was ranged approximately 0.06 M to 0.07 M for five g of the BPS sample. Hence, it is good as the higher simple sugar or glucose (WSC), the better fermentation and VFA presence in the silage (Hansson, 2012). Higher WSC will increase lactic acid that act as energy substrate (Cecava, 1995; Seglar, 2003) that will be used by cow and goat. In addition, the higher lactic acid proportions in the feed will proliferation the lactation especially towards dairy cow and cattle (Agarwal *et al*., 2015).

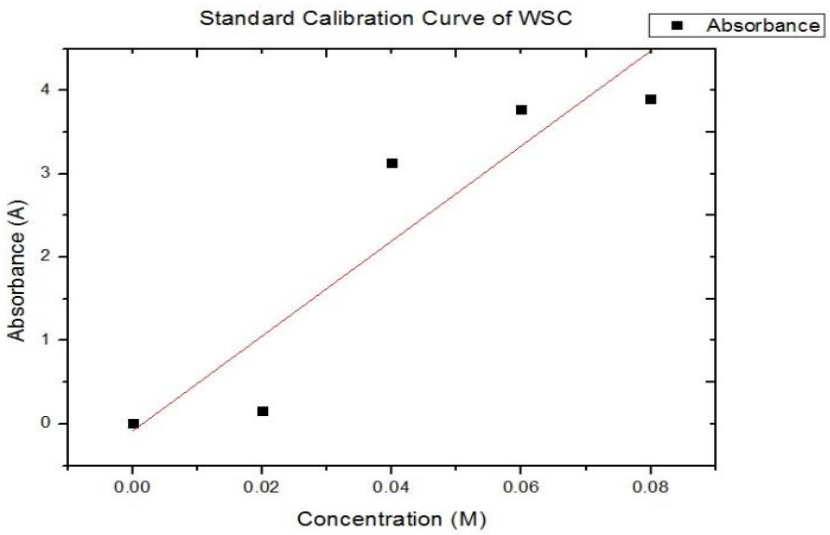

Figure 1. WSC Standard Calibration Curve

3.5 pH Analysis

The BPS pH analysis was for nine samples from single drum. There were three samples of layer in one drum. Based on the mean value of the pH value, for layer one was 3.99. Next, in layer two, the mean value of the pH was 3.97 and lastly in layer three, the mean value of pH was 3.93. These mean values of pH were added up giving a total mean of the silage pH in the drums is 3.96. Table 3 show all the pH values recorded.

Table 3. pH Analysis

Samples	pH value
T1 L1 S1	3.99
T1 L1 S2	4.01
T1 L1 S3	3.97
T1 L2 S1	3.94
T1 L2 S2	3.93
T1 L2 S3	4.03
T1 L3 S1	3.93
T1 L3 S2	3.95
T1 L3 S3	3.92

3.6 FT-IR Analysis

The main reason for BPS analysed by FTIR was to know whether there is presence of carbohydrates or not. Based on the spectra obtained as shown in Figure 2, the BPS was proven as it contained carbohydrates that was important parameter to know whether the fermentation process were good or not. Based on the result obtained, there is presence of sugar (carbohydrates) in the BPS. This can be seen through appearance of broad

absorption band of hydroxyl group (OH) at range between 3400 cm^{-1} to 3200 cm^{-1}. This results is well-matched with Santos *et al*., (2015) based on their previous study. Also there is supported proof as presence of ether group,(C-O-C) and carbonyl group, (C-O) dominated by ring vibrations of carbohydrates at range between 1247 cm^{-1} to 1000 cm^{-1}.

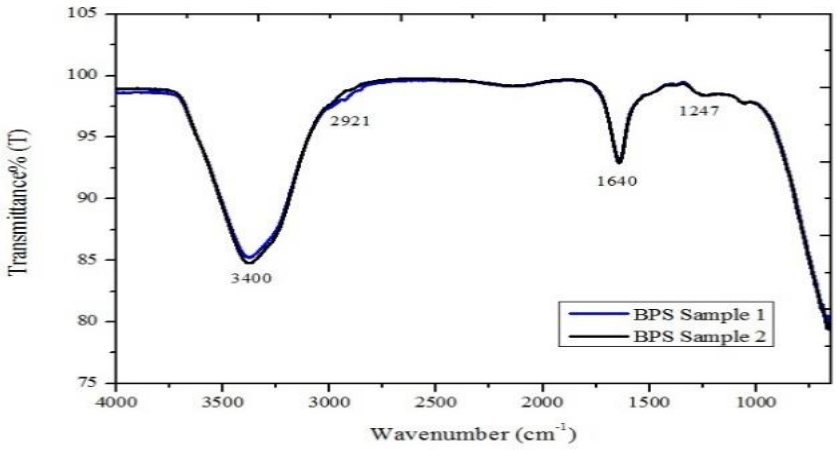

Figure 2 BPS FT-IR Spectra

4. Conclusions

In conclusion, alternative livestock feed from fermented banana peel can be produced as it compatible with the data from previous study based on some of the parameter like pH value, physical observations (colour and odour) , dry matter (DM) content, ash content, water soluble carbohydrates (WSC) concentrations. For pH analysis which was measured after the ensiling process, the average pH value was obtained at 3.96. Low pH value indicates a good and high quality of silage. By using physical observations (colour and odour) can easily show whether how well silages was fermented. Result obtained show the colour of silage was light green and the odour was mild and sour milk smell. This colour and odour were preferable for good quality silage.

The DM and ash contents were 45.67 % and 5.21 % respectively as these value were compatible for livestock feed. By determining the DM content of feed, it provides a measure of the amount of a particular feed that is required to supply a set amount of nutrients to the animal. Increases or decreases in feed DM content result in over or under feeding of nutrients. Correspondingly, determining the ash content may be vital for a number of reasons. It is a part of the contiguous analysis for nutritional evaluation. WSC of BPS was analyzed by UV – VIS Spectrophotometer and the absorbance acquired was 3.66. By comparing to the standard calibration curve, the concentration of glucose in BPS ranged approximately from 0.06 M to 0.07 M for 5 g of the BPS sample. This glucose presence was proved by FTIR analysis for the BPS. Based on FTIR spectra, there is an advent of broad hydroxyl group (OH) at range between 3400 cm^{-1} to 3200 cm^{-1}. In addition, also there is supported proof as presence of (C-O-C), (C-O) dominated by ring vibrations of carbohydrates at range between 1247 cm^{-1} to 1000 cm^{-1}

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