Aloe vera Used as Nutritional Supplement for Caprines

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ABSTRACT

The potential of *Aloe vera* bark residues as a nutritional supplement for caprine physical-chemical characterization was used to determine humidity (2.76% ± 0.12); pH (4.45 ± 0.10); raw protein (4.37% ± 0.13); ethereal extract (2.15% ± 3.06); raw fiber (16.94% ± 0.52); (cellulose 19.76% ± 0.20); (lignin 9.68% ± 0.30); hemicellulose (12.45% ± 0.39); and total ashes (13.68% ± 1.62). These results are comparable to sugar cane bagasse, banana, oranges, and algae as nutritional supplements for animals.

Key words: *goat,* Aloe vera, *nutritional supplement*

INTRODUCTION

The new millennium has moved toward more use of agro-industrial residues, partly because their components may be used as raw material to produce important products, such as animal feeds (Martin, 2009). Accordingly, there have been reports on sugar cane bagasse (Peláez *et al*., 2008), rice hulls (Martin, 2009), coffee pulp (Noriega *et al*., 2008), and apple wastes (Díaz *et al*., 2010). Using residues also helps reduce transportation costs to the landfills, also reducing environmental impact (Saval, 2012).

Agro-industrial wastes are an important source of sugars, starch and cellulosic materials. To use them in animal diets, residues undergo chemical processes to adapt their structure, and their nutrient potentials are improved, by increasing their protein contents and digestibility, with microorganisms, like fungi (Gómez *et al*., 2013).

In Falcón, Venezuela, caprine raising is performed extensively by small farmers organized in socialist networks for productive innovation. The locations include arid and semi-arid climates, suitable for this animal species adaptation. Animals are grown for their meet, milk and by products (manual cheese and milk sweet making) People´s Ministry for Agriculture and Land Use, 2008; Morrillo, 2010).

In the area, a factory specializes in cosmetics and flavored beverages based on *Aloe vera*. It produces three tons of bark residues every day, and the figure tends to increase, as production steps up to meet the local and regional markets. The residues are processed into powder which is stored in plastic bags for disposal (Humbría, 2010).

The purpose of this research was to evaluate the physical-chemical features of *Aloe vera* residues, in order to include them in the diet for caprines.

MATERIALS AND METHODS

The study was developed at the agro-industrial processes unit (UPAGRIN), associated to the Center for Technological Research (CITEC in Spanish), Francisco de Miranda National Experimental College, Venezuela

Raw material

Random samples of dehydrated or ground *Aloe vera* residues were collected between August and November 2013 (4 kg), from the cosmetics and beverages factory, located in Coro, Falcon State, Venezuela. The samples were preserved in polyethylene bags tightly sealed, at -8º C, until physical-chemical determinations took place.

Physical-chemical characterization of Aloe vera *residues*

Humidity and total ash per cents were measured by gravimetry (COVENIN 1156-79; COVENIN 1115-79); the pH was determined by potentiometry (COVENIN 1315-76-179); raw protein content was determined by Micro Kjedhal (AOAC, 1980); ethereal extract was determined by Soxtec (CONVENIN 1194-79); raw fiber was calculated by sample digestion with sulphuric acid (COVENIN 1162-79). Cellulose and lignin were determined sequentially in closed reflux in acidic medium, and by direct gravimetry of the residue

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(Abdullah *et al*., 2006). Hemicellulose was estimated by indirect gravimetry. All determinations had four replicas

Statistical processing

Statigraphs Centurion XV was used in a normality test (Shapiro-Wilk) to check the distribution of physical and chemical parameters.

RESULTS AND DISCUSSION

The physical-chemical parameters of *Aloe vera* residues showed normal distribution (see table).

One of the parameters mentioned in similar studies is related to lignocellulosic contents. *Aloe vera* residues are abundant in lignocellulose. In this particular case, the presence of cellulose, hemicellulose and lignin is remarkable. When these results were compared with results from other authors, their values were lower than Valiño *et al*. (2004), when characterizing corresponding data of algae and sugar cane bagasse. However, the content of lignin was with the 5.2-0.85% interval, reported by Paredes *et al*. (2010), who used banana residues.

The raw fiber content was within the interval reported by other researchers for similar agro-industrial residues. It comprises non-digestible carbohydrates in the material. Therefore, the greater the concentration, the lower the nutritional value. Nevertheless, this feature constitutes no limit when they are used as raw materials for animal feed, through fermentative processes, especially fungi (Paredes *et al*., 2010; Pinero and Díaz, 2010).

The values for total ashes are compared to the per cents reported by other authors: slightly above Bravo *et al*. (1998), *and below reports by Paredes et al.* (2010). It depends on the content of minerals present in the bark, which, in turn, rely on the field conditions where the plants have been grown (Zúñiga and Gutiérrez, 2020). The variety of ash components are often essential nutrients for fungal growth, when microorganisms are used to enhance plant residues by fermentation (Moyano *et al*., 2014).

The natural bark of *Aloe vera* is a *proteinaceus* residue. Although the values corroborated are below 5.95% (Pinero and Díaz, 2010), it is one of the parameters that can be improved by solid phase fermentation, as shown by treatments to similar residues Rodríguez Piñero, 2007; Díaz *et al*., 2010).

The ethereal extract comprises lipid contents from the bark of *Aloe vera*. The values found were slightly higher than reports by Paredes *et al*. (2010). It is an indicator that has a positive effect when the residues undergo microbial fermentation to enhance their nutritional qualities, especially when fungi are used (Prescot *et al*., 1999).

The bark´s pH is acidic, which is related with organic acids found in their chemical composition (Domínguez *et al*., 2012). Acidity ensures prevention of residue degradation caused by bacteria. As in other similar cases, when it becomes a fermentative substrate, the pH values must be adjusted to 5.5 and 6.2 (Ferrer *et al*., 2011).

Humidity of the residue studied remains low due to industrial drying. Under 10%, it prevents deterioration caused by epiphyte micro biota that erodes its quality (Berradre *et al*., 2009). As mentioned above, the pH values must be adjusted to 60-70%, because it is an important variable for fungal growth (Berradre *et al*., 2009; Ferrer *et al*., 2011; Manjarres *et al*., 2011).

CONCLUSIONS

Aloe vera bark residues have compatible physical-chemical features with other raw materials used for caprine feed.

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Table. Physical-chemical features of *Aloe vera* residues

	Physical-chemical indicators								
Statigraph	% H	pH	% PC	% EE	%RF	% Cel	% Lig	% Hcel	%TA
Mean achieved	2.76	4.45	4.37	2.15	16.94	19.76	9.68	12.45	13.68
Variation coefficient (%)	4.16	2.26	2.99	3.06	0.52	1.03	3.13	3.14	1.62
Standard bias	-1.07	-1.43	-0.28	0.58	-0.23	-0.27	-0.10	-0.70	-0.39
Standard kurtosis	0.97	1.29	0.63	-0.24	-1.37	0.18	-0.61	-0.52	-0.69

Legend: H: humidity; EF: ethereal extract; RF: raw fiber; Cel: cellulose; Lig: lignin; HCel: hemicellulose; TA: total ashes