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# Treatment of vinasse through a bacterial process

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**Abstract:**This article presents the importance of the treatment of vinasse in sugar-alcohol plants in which a process with decomposing microorganisms is used, in which the pH, Potassium and the percentage of sucrose present in the pulp are evaluated, which provides an acceleration in the process and helps in the environmental control and reducing operational and process costs.
**Keywords:** vinasse, microorganisms, sugarcane mill.

## 1. Introduction

According to Kyotoku (2011) sugarcane is a culture linked to the economic growth of Brazil, having a monopoly in its production from the discovery of Brazil until the 17th century, losing leadership to other countries until the year 1980, when it re-assumes the ranking. Currently, sugarcane occupies more than eight million hectares, approximately 2.5% of all Brazil's arable land. It is also expected that the production of sugarcane will double in volume in the next decade.

According to Rossetto et al (2006), several materials are obtained from the production of sugar and alcohol in a sugar-alcohol plant. However, the knowledge of the composition and possible uses of these materials in crops allowed their use in the form of organo-mineral fertilizers and fertirrigantes. This provided a greater environmental control and relevant savings in sugarcane fertilization.

Vinasseis a residue from the distillation of alcohol, which has been used in many places as fertilizer in the cultivation of sugar cane. When properly applied, vinhoto provides biological, physical and chemical benefits to the soil, increasing crop productivity and development, through increased fertility, porosity, and water retention. For each liter of alcohol produced, 10 to 15 liters of vinasse is generated, which has a high biochemical oxygen demand (BOD), consuming around 12,000 to 20,000 milligrams for each liter of vinasse. Because it has a high polluting power, the study of its disposal is of great importance to the environment, in which the elements possibly affected most are the surface, ground and groundwater sources (KYOTOKU, 2011).

Still according Rossetto; Santiago (2006), although vinasse and filter cake had their nutritional values known since the 1950s, their use began only in the 1970s and intensified in 1999, when the exchange rate and the rise in the prices of chemical fertilizers increased fertilization and the environmental issue gained more space.

According to Rafaldini et al. (2006), the volume of vinasse generated is much higher than the demand for soil application, that is, the area that receives the fertirrigation does not take advantage of the total vinasse generated, and the surplus becomes a problem for treatment and final disposal. Thus, the leftovers left in the tanks and channels are in the process of decomposition, causing bad odors, creating a situation of discomfort, discomfort and risk of health problems in the surrounding community.

According to Lamaison et al (2013). Vinasse pretreatment is used as a strategy to suppress the activity of $H_2$-consuming bacteria in the biodigestion process, while preserving the activity of $H_2$ producers.
According to Loss (2011). Through physical-chemical analysis it is possible to confirm the high high content of potassium, magnesium and organic matter.

Still according to Rossetto et al (2006) dose of vinasse to be applied in sugarcane is defined based on its potassium content and soil chemical analysis. The excess of vinasse causes delay of the process of maturation of the plant, which leads to the decrease in sucrose content and compromises the final quality of the cane.

According to Corazza (2006), both groundwater contamination and soil salinization are treated as "risks" and the studies on these possibilities are still inconclusive. Faced with these risks, the question is whether fertigation would not only be a palliative, short-term, or emergency solution to the problem of vinasse disposal. It is also doubtful whether the abandonment of efforts to develop the anaerobic digestion of the waste was premature.

Also according to Corazza (2006), what is clear is that more research would be needed to clarify these

doubts. In the absence of such clarifications, we will have the impression that we are faced with a case where the retained solution means nothing more than a quick and cheap practice of ridding the agro-industry of sugar and alcohol of a polluting, uncomfortable and even dangerous waste.

This article presents the importance of the treatment of vinasse in sugar and ethanol plants in which a process with decomposing microorganisms is used, accelerating the process and helping in environmental control and reducing process and operational costs.

This work aims at the treatment of vinasse in sugar and alcohol mills, being made by microorganisms capable of biodegrading the waste from sugar and alcohol production through decomposition.

## 2. Methodology

In the development of the methodology of the present work, the authors begin with a bibliographical research, searching in different authors, methodologies that guide the use of the research without the soil, trying to find itself as soon as possible of its dosage without harming the soil, observing. The dosage of cake for a better control over the pH of the vinasse is acidically +/- 4.0. In this search the authors set up a theoretical article with 6 articles, in which they were read and duly documented so that they could extract important information about each of them. As of now, all articles are introduced in an ethanol plant. For the collection of material, the dose used was a 500 mL vial. After the samples were collected the integrity of the samples was made using the appropriate materials and equipment.

## 3. Material and Methods

### 3.1 Materials and Equipment:

2000 mL vials; Ashes Conductivity Meter; 5L bottle; Analytical balance; 100 mL volumetric flask; 100 mL Becker; 300 g of bacteria (Eflugard); Filter Paper; Plastic funnel; pH meter; 500 mL bottle; Saccharimeter; 250 mL test tubes.

### 3.2 Analysis of the quantity of waste in vinasses

A 1000 ml vial portion was placed in four vials of 2000 ml in each of the vials, which were kept at a temperature of approximately 35°C. A daily dosage of 5 g of bacteria (EFLUGARD) was carried out daily in each 1000 ml sample. Four types of samples were added separately: Being a blank sample (without dosage), In the 1st sample the bacterium was dosed during fifteen days, In the 2nd sample it was dosed for twenty days, And finally, in the 3rd sample for twenty-five days. After the analyzes were completed, the samples were placed in 250 mL beakers to verify the result.

### 3.3 pH analysis

To verify the pH of the vinasse, a 100 mL Becker was transferred to the vinasse sample, after the calibration of the pH meter, the electrode was taken to the Becker containing the sample and the pH was read.

### 3.4 pH Control

To test the pH of the vinasse mixed with the pie, three dilutions were performed:

Initially the vinasse contained pH = 4.18.
Starting the first dilution, a 250 mL Becker was taken and 100 mL of vinasse plus 10 grams of cakewas added, shaken with a stick for better dilution, then sampled to a pH meter for pH reading.

In the second dilution a 250 mL Becker was taken and 100 mL of vinasse plus 50 g of cake added, shaken with a stick for better dilution, and then taken to a pH meter for pH reading.

And finally in the 3rd dilution, a Becker of 250 mL was taken and 100 mL of vinasse with another 100 grams of cake was added, shaken with a stick for better dilution, then the sample was taken to a pH meter for pH reading. Thus raising the pH to obtain a better control over the dosages of vinasse and cake in the application of the crop.

### 3.5 Potassium Analysis

A sample of 26 g of vinasse was placed in a 100 mL volumetric flask, then the volume was filled with distilled water to the meniscus, and the sample was again transferred to a 100 mL Becker, which was taken to ash conductivity meter for reading expressed in Kg / $m^3$.

### 3.6 Polarization Analysis (Pol)

Pol: Percentage by mass of apparent sucrose contained in a sugar solution of normal weight, determined by the deviation provoked by the solution in the plane of vibration of polarized light.

To perform the percentage analysis of the cake, which aims to show the percentage of bulk of apparent sucrose contained in a sugar solution, were placed in a vial of 500 mL, 25 g of cake, adding from 0.8 to 1, 0 g of octapol (clarifier), which were subsequently dissolved in 100 mL of distilled water. The sample was transferred to a 200 mL"*kobrausch"* flask and the volume was filled with distilled water to the meniscus. A simple filtration was carried out, taking the filtrate to the saccharimeter to perform the reading and obtaining the percentage of the sucrose.

## 4. Results and Conclusions

**1st RESULT**

It was possible to verify in the first sample the beginning of flocculation and with an already lower percentage of residues. In the second sample, a better result was obtained, with a much smaller amount of residues. In the third sample, it obtained flocculation with a darker liquid in the upper part. In this experiment it was possible to observe, as shown in Figures 1 and 2, that the bacteria do indeed yield positive results, because on these test days the samples actually decreased the residues.

**Figure 1:**Vinasse before treatment.

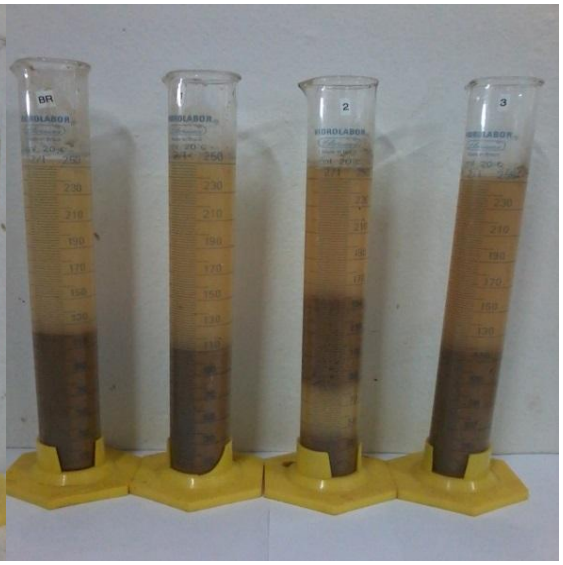

**Figure 2:**Vinasse after treatment.

**2nd RESULT**

In a 40,000 m³ vinasse pond, a certain amount of vinasse was placed in a 500 mL vial. Was transported to an analysis laboratory where a sample amount was transferred to a 100 mL Becker, thereby achieving the same pH , with a properly calibrated pH meter; obtaining pH = 4.18, which is allowed to state that indeed the pH of the vinasse is acidic.

**3rd RESULT**

To show the result in percentage of potassium in the vinasse sample: 25 grams of vinasse was weighed into a 200 mL flask, completing the volume with distilled water until the meniscus. Afterwards, it was carried out to an ash conductivity meter to carry out the percentage of potassium, in which the result was: K = 1.94 (kg /$m^3$).

**4th RESULT**

To show the amount of sugar remaining in the cake sample by reading on a saccharimeter: A 250 mL Becker was weighed 25 grams of cake sample, filling the volume with distilled water to the meniscus, then carrying the sample to a saccharometer for reading the sugar percentage. In which the result obtained was: Pol = 1.54%.

**5th RESULT**

Table 1 shows the results of the dilution done in the laboratory. It is concluded that the more crooked with vinasse in soil, the higher the pH value (Figure 3), the less acidic and the less aggressive the soil.

**Table 1:** Dilution (vinasse x cake).

| VINASSE | CAKE | pH |
|---|---|---|
| 100 mL | 10 g | 4,5 |
| 100 mL | 50 g | 5,4 |
| 100 mL | 100 g | 5,8 |

## 5. Final Conclusion

We came to the conclusion that the controlled use of vinasse and filter cake is recognized as a good practice in cane culture from an environmental and productive point of view. Since it allows the total recycling of industrial waste (vinasse, filter cake and washing water - soil cleaning, closed loop purging and remaining condensates), increased soil fertility, reduced water intake for irrigation, reduced use of chemical fertilizers and associated costs.

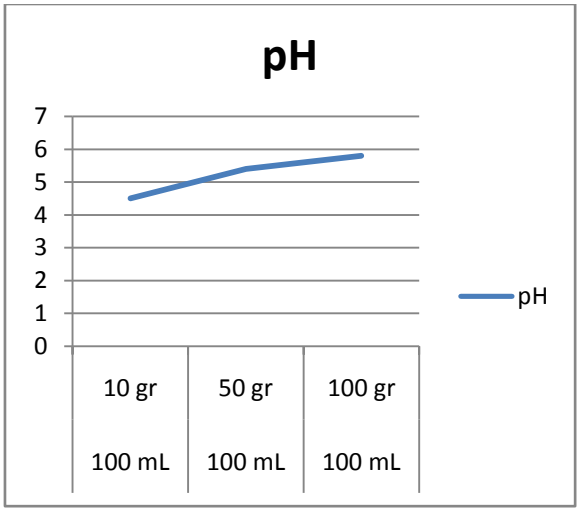


**Figure3:** pH x dilution.

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