

PURATE™ Technology Improves Microbiological Control in the Fermentation of Sugar-Cane Ethanol to Increase Production Efficiency



BACKGROUND

A sugar cane processor, located in the Triangulo Mineiro region of Brazil, is among the country's key producers of ethanol, sugar and bioelectricity. With an annual processing capacity of 15 million tons of sugar cane, the plant produces 500,000 m3 of ethanol, 1 million tons of sugar and 700,000 MWh of energy per year.

In addition to their contributions to the regional economy, the company also has a strong commitment to corporate responsibility. The preservation of nature and care for human life are key priorities.

In the ethanol production process, yeast is used as a biological agent to transform sugars into ethanol during fermentation. At this stage, it's critical to control bacteria populations as they compete with yeasts for the sugars present in the fermentation medium. Bacteria consume sugar and produce acids, reducing the efficiency of ethanol production.

At the end of fermentation, the yeast is recovered and sent to a yeast treatment

tank (YTT), where sulfuric acid is used to adjust the conditions of the medium and control the bacterial population. In this process, the control of the acid dosage is extremely important, since excess acid reduces the activity of the yeast, resulting in a drop in ethanol production.

To help control bacteria, the customer used a sodium chlorite-based product (NaClO_2) added directly to YTT, which in contact with the acid medium ($\text{pH} < 2.5$) releases chlorine dioxide (ClO_2) acting as a biocidal agent. Since there is no control of the reaction, the conversion rate of NaClO_2 to ClO_2 is low, resulting in a higher consumption of product. This approach also requires the use of more sulfuric acid in the fermentation, reducing the efficiency of ethanol production and increasing the cost of bacteria control.

The customer needed a microbiological control program that would guarantee good fermentative efficiency and reduce the total cost of production. The plant contacted Nalco Water for help.

ANNUAL SAVINGS



COSTS

Reduced biocide and sulfuric acid consumption by more than

235,000 kg
per year



PROFITABILITY

Increased fermentation efficiency by

0.15%
per year



TOTAL VALUE DELIVERED

Total savings of

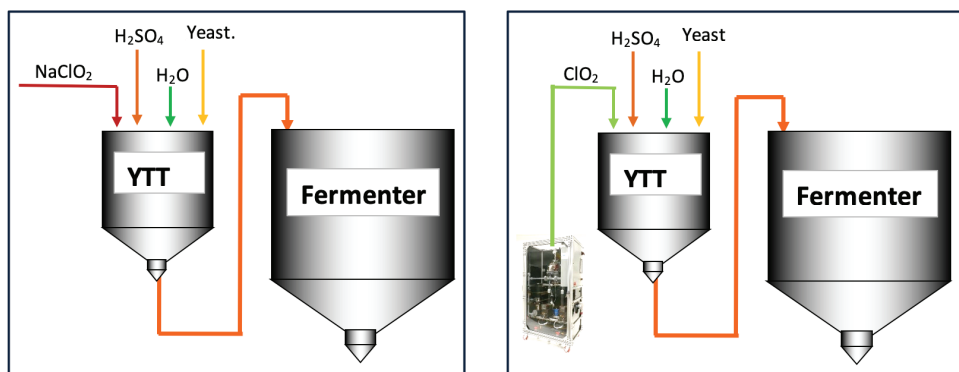
\$218,000
ANNUALLY

SOLUTION

To improve microbiological control, the Nalco Water team used PURATE™ technology, which unlike other programs, produces ClO2 in an appropriate generator, under controlled conditions, resulting in greater safety and efficiency in the application while ensuring the adequate amount of biocide without damage to yeast or to the environment.

One of the benefits of ClO2 is that it does not react with ammonia, organic acids, alcohols and glycols, present in the fermentation medium, thus being more effective in controlling bacteria.

The aqueous ClO2 solution generated by the PURATE technology was added directly to the YTT, ensuring the correct dosage for bacteria control.



Graph 1. Before: Conventional process

Graph 2. After: PURATE TECHNOLOGY

RESULTS

Based on the production of ethanol of 120,000 m3/year, with the price of ethanol at USD \$0.572/liter and sulfuric acid at USD \$0.324/Kg, plus the replacement of NaClO2 by PURATE technology, the plant registered the following gains:

	Unit	Before	After	Gains
Sulfuric acid	Kg/m3	12.2	10.4	1.8
Fermentation Eff.	%	90.20%	90.35%	0.15%
Biocidal Consumption	Kg/year	95,000	76,000	19,000

CONCLUSION

With the use of PURATE technology in the microbiological control of fermentation, it was possible to reduce the consumption of sulfuric acid applied in YTT, as well as the volume of total biocide. With better control of the bacterial population, there was an increase in fermentation efficiency and a consequent increase in ethanol production.

Nalco Water, an Ecolab Company

North America: 1601 West Diehl Road • Naperville, Illinois 60563 • USA

Europe: Richtstrasse 7 • 8304 Wallisellen • Switzerland

Asia Pacific: 52 Jurong Gateway Road, #16-01 Jem Office Tower, Singapore 608550

Greater China: 18G • Lane 168 • Da Du He Road • Shanghai China • 200062

Latin America: Av. Francisco Matarazzo • n° 1350 • Sao Paulo – SP Brazil • CEP: 05001-100

Middle East and Africa: Street 1010, Near Container Terminal 3, Jebel Ali Free Zone, PO BOX 262015, Dubai UAE

ecolab.com/nalco-water

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