Acidic Calcium Sulfate to Control Microbial Growth in Apple Wine

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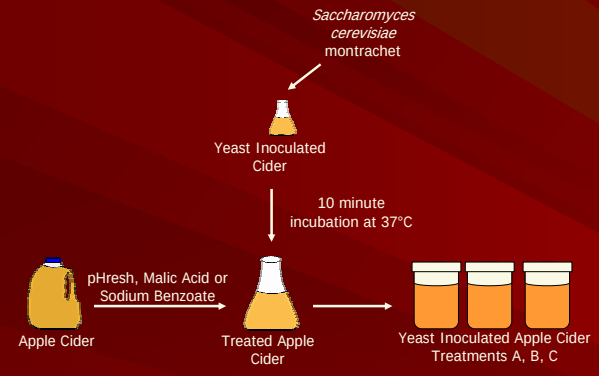
ABSTRACT

The antimicrobial effects of acidic calcium sulfate (trade name pHresh 5.0) produced by pHresh Technologies were tested in pasteurized, unfiltered apple cider (*Malus domestica* cv Red Delicious). Efficacy of acidic calcium sulfate was compared with that of malic acid and sodium benzoate. Acidic calcium sulfate and malic acid were used to adjust apple cider samples to pH values of 3.0, 3.2 and 3.5. Apple cider samples were also treated with sodium benzoate at 0.1% by weight. After samples were adjusted to appropriate pH levels or sodium benzoate was added, they were inoculated with *Saccharomyces cerevisiae* montrachet, a typical wine fermentation yeast (Red Star). Inhibition of yeast and mold was monitored by a plate count enumeration method using potato dextrose agar with tetracycline. The cider was plated every 48 hours for 8 days; and subsequently every 96 hours until day 32. Fermentation rate was observed by monitoring the pH, titratable acidity, percent alcohol, degrees Brix and carbon dioxide bubbles escaping from the fermentation lock. The use of acidic calcium sulfate to adjust pH increased the rate of alcoholic fermentation and inhibited the growth of film yeasts and molds. Malic acid did not affect the rate of alcoholic fermentation and sodium benzoate inhibited the growth of yeast and mold. Acidic calcium sulfate may aid in the production of apple wines by speeding the fermentation and inhibiting mold while keeping the pH, titratable acidity and percent alcohol near their expected values.

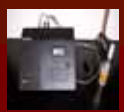
MATERIALS AND METHODS



Titratable acidity was measured by titrating an apple cider sample to a pH end point of 8.2 using 0.10N sodium hydroxide. A standard conversion formula was used to convert the milliliters of sodium hydroxide added into the titratable acidity values.

A hand held refractometer was used to determine the percent soluble solids or sugar content of the apple cider samples.

Apple cider samples were plated on potato dextrose agar with tetracycline to determine the amount of active yeast present. The plates were incubated at room temperature and then counted after seven days.



A pH meter with a temperature compensating electrode was used to determine the pH values of the samples.

Bubble clusters passing through the fermentation lock were counted to evaluate the presence of carbon dioxide gas formation.

An enzymatic reaction test kit manufactured by Megazyme was used to determine the percent alcohol. A spectrophotometer was used to measure absorbance changes during the reaction which were converted into percent alcohol content.

OBJECTIVES

- Monitor changes in typical wine characteristics including percent alcohol, titratable acidity, sugar content, and pH
- Compare the fermentation results in conditions created by malic acid to that of acidic calcium sulfate
- Determine if acidic calcium sulfate is able to prevent spoilage of the samples

pHresh INFORMATION

- Liquid acidifier with little or no acidic taste, colorless, and odorless
- Prevents enzymatic browning of fruits and vegetables
- Wide range of product applications including, sauces, dressings, bakery items, beverages, or any ready to eat foods
- Allows preservation of high moisture products due to its antimicrobial properties
- FDA approved with generally recognized as safe status

RESULTS

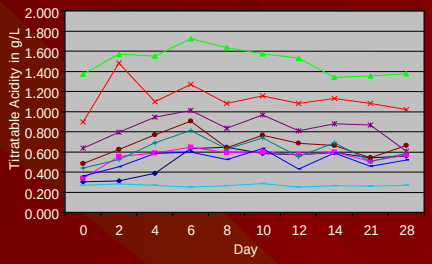


Figure 1. Titratable Acidity Values of Apple Cider Samples Over Time

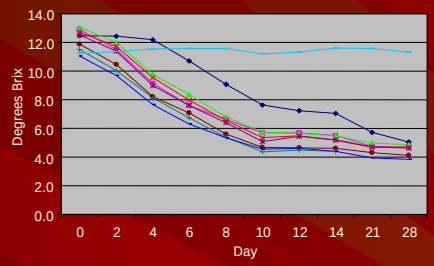


Figure 2. Sugar Content in Degrees Brix of Apple Cider Samples Over Time

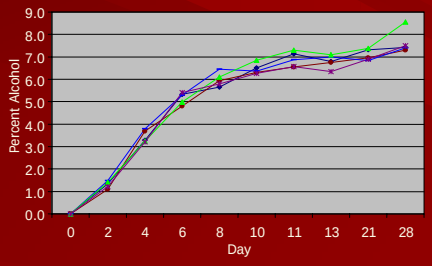


Figure 3. Percent Alcohol Content of Apple Cider Samples Over Time

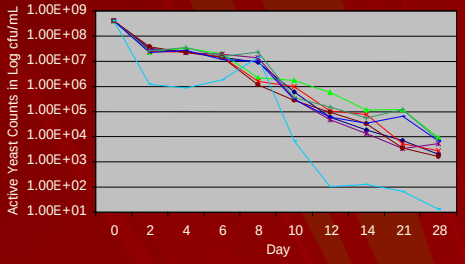


Figure 4. Active Yeast Counts of Apple Cider Samples Over Time

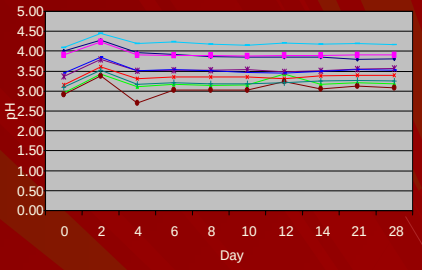


Figure 5. pH Values of Apple Cider Samples Over Time

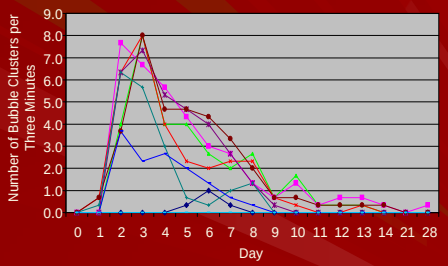
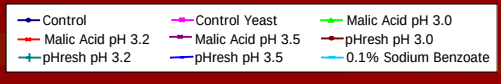


Figure 6. Carbon Dioxide Gas Evolution from Apple Cider Samples



CONCLUSIONS

- The percent alcohol, titratable acidity, sugar content and pH values were within the expected range for wine making in the acidic calcium sulfate and malic acid treatments
- Acidic calcium sulfate and malic acid were able to hold the titratable acidity values at constant levels. The malic acid samples had higher titratable acidity values due to it being a stronger acid than acidic calcium sulfate. This suggests that it may be possible to lower the pH with acidic calcium sulfate and control microorganisms without altering the titrable acidity and therefore maintain a desirable flavor profile.
- Acidic calcium sulfate, malic acid, and sodium benzoate were able to inhibit film yeasts and mold