

# A study of the vinegar fermentation essay sample



**ASSIGN  
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1 A scientific paper submitted in partial fulfillment of the requirements in HNF 12 laboratory, 2nd sem., 2012-2013.

## OBJECTIVES

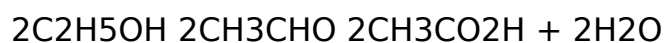
1. To enumerate the principle and methods in fermentation; and 2. to identify the factors that affect the efficiency of fermentation.

## INTRODUCTION

Vinegar has been traditionally used as a food preservative. Vinegar retards microbial growth and contributes sensory properties to a number of foods. The wide diversity of products containing vinegar (sauces, ketchup, mayonnaise, etc.) and the current fall in wine consumption have favored an increase in vinegar production (De Ory et al 2002).

Acetic acid is the predominant flavoring and antimicrobial component in vinegar. Vinegar bacteria, also called acetic acid bacteria, are members of the genus *Acetobacter* and characterized by their ability to convert ethyl alcohol,  $C_2H_5OH$ , into acetic acid,  $CH_3CO_2H$ , by oxidation as shown below;

Anaerobic Aerobic



Most bacteria strains derived from vinegar factories are able to oxidize acetic acid to  $CO_2$  and  $H_2O$  (over-oxidation) and therefore are classified in the genus *Acetobacter* (De Ley et al 1984).

Acetic acid is formed in a four-step reaction involving conversion of starch to sugar by amylases, anaerobic conversion of sugars to ethanol by yeast

fermentation, conversion of ethanol to hydrated acetaldehyde, and dehydrogenation to acetic acid by aldehyde dehydrogenase (Nichol 1979; Canning 1985). The last two steps are performed aerobically with the aid of acetic acid forming bacteria.

Acetic acid fermentation is done in a sugary medium. It consists of the fermentation of alcoholic substrate to acetic acid by acetic acid bacteria or vinegar bacteria.

BFAD defines that vinegar should contain 4% acetic acid expressed as lactic acid.

Two common market forms of vinegar include natural, a vinegar that undergoes fermentation resulting in the formation of good aroma and flavor. It takes months to years of fermentation before these kinds of vinegar are produced, while the other one is synthetic, which is prepared from chemical additives like glacial acetic acid just as long as the concentration of acetic acid is 4%. A 4% acetic acid can be easily prepared by mixing one part of the acid to 96 parts of water (HNF 12 lecture handout).

## MATERIALS AND METHODS

1 gallon bottle Strainer

Fermentation cock Muslin cloth

Treatment used: coconut water + sugar

Ingredients:

8 cups coconut water

4 cups mother vinegar

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1 cup sugar

Procedure:

First, coconut water was strained using the muslin cloth (katsa). This is done to remove the remaining coconut and other foreign particles. Sugar was then added and was agitated until all crystals were dissolved. The initial titratable acidity (TA) was also obtained by titrating a mixture of 5 mL sample + 5 mL distilled water + 3 drops of phenolphthalein (indicator). Temperature was also measured using a thermometer. After all initial measurements, the mixture was covered and allowed to ferment. Titratable acidity was also monitored every week until a 4% acetic acid was reached. Formula of % Titratable Acidity is given below:

$$\%TA = \frac{(\text{volume of NaOH})(N \text{ of NaOH})(\text{Molecular weight of CHCOOH})}{\text{Volume of sample used}} \times 100$$

## RESULTS AND DISCUSSIONS

$$\%TA \text{ ( 1st week)} = \frac{(1.18 \text{ mL NaOH})(0.1 \text{ N NaOH})(.06 \text{ CHCOOH})}{5 \text{ mL}} \times 100$$

$$= 0.14 \%$$

$$\%TA \text{ (2nd week)} = \frac{(1.6 \text{ mL NaOH})(0.1 \text{ N NaOH})(0.06 \text{ CHCOOH})}{5 \text{ mL}} \times 100$$

$$= 0.19\%$$

$$\%TA \text{ (3rd week)} = \frac{(28.2 \text{ mL NaOH})(0.1 \text{ N NaOH})(.06 \text{ CHCOOH})}{5 \text{ mL}} \times 100$$

$$= 3.38 \%$$

Data and computation above showed the % TA of the vinegar fermented. The initial %TA of the solution was 0.14%. On the second week, it increased by a minimal percent and turned 0.19%. Lastly, final % TA obtained was 3.38%. The vinegar fermented almost reaches the ideal acidity of the vinegar which is 4%, meaning, the bacteria did not completely converted all the substrate into acetic acid.

## SUMMARY AND CONCLUSION

The fermentation did not reach the ideal and standard acidity of vinegar due to the inadequate oxygen present and bacteria which is incapable of further converting the alcoholic substrate into vinegar. As the Acetic Acid Bacteria requires oxygen to oxidize ethanol into acetic acid, the air lock used for fermentation is no longer necessary and the presence of air, and oxygen contained within the air, becomes very important. Acetic Acid Bacteria are now facultative aerobes, meaning, there must be oxygen to thrive. Another factor to consider with Acetic Acid Bacteria, as with most microorganisms, they are adapted to living in solutions rich in their metabolites. This is normally carried out using an older batch of vinegar made from the same source.

## RECOMMENDATIONS

It is recommended that proper measurements and methods are followed. Also, proper recording of titratable acidity must be observed. Slow fermentation process, which was done in this experiment or the generator process can be substituted with other faster methods using a more efficient

fermentor like in submerge processes which can produce vinegar with an acid strength of 12% or more in a shorter period of time.

#### LITERATURE CITED

De Leon, S. Y, Chavez L. L, Claudio, V. S. and Matilde P. Guzman. Basic Foods for Filipinos. 3rd edition. Philippines: Merriam & Webster Bookstore.

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