



Vinegar Infos

The Production of Cider Vinegar in the Acetator

Introduction

Contrary to alcohol mash for the production of alcohol or spirit vinegar, cider as raw material has a high content of extract substances. Its low acidity (usually about 0.6% weight by volume of acetic acid) and the high concentration of minerals and vitamins make cider particularly prone to contamination by bacteria or yeasts.

Raw Material and Alcoholic Fermentation

Cider can be obtained from apple juice or apple juice concentrate by alcoholic fermentation. Apple juice normally contains approximately 10 -12% sugar, apple juice concentrate may contain as much as 60-80% sugar.

Though cider can be fermented to cider vinegar after the settlement of the yeast, manufacturers normally prefer to remove the yeast from the cider by centrifugation or clarifiers. Immediately after clarification, the cider has to be denatured with cider vinegar produced in an Acetator. It should then contain approx. 1.5% by weight of acetic acid in case of cider of a low alcohol concentration or approx. 1% by weight of acetic acid in the case of cider with a high alcohol concentration.

Following denaturing, the mash should be stored for a week or two prior to the actual vinegar fermentation in order to remove as much carbon dioxide from the alcoholic fermentation as possible. Using very fresh mash for cider fermentation frequently leads to heavy foam formation, whereas a very long storage may foster contamination by all kinds of bacteria, and may thus lead to lower yield rates and to poorer quality.

Vinegar Fermentation

Cider vinegar production in the Acetator either takes place in low strength or high strength fermentation. Whereas the former presents almost no difficulties except possible contamination, the latter proves a little more difficult in terms of nutritive and bacterial requirements.

Low-Strength Cider Vinegar

This term stands for cider vinegar produced from cider of a total concentration (acid % by weight plus alcohol % by volume) of less than 8-9%. To start such a fermentation in the Acetator, a starter mash has to be prepared consisting of cider and vinegar. The concentrations in the mash should be approx. 55% acetic acid and 45% alcohol. For acidification, filtered vinegar from an Acetator should be used. A starter vinegar

containing the appropriate bacteria culture as well as Frings nutritive salt (0.1-0.3 g/liter fermenter volume) is then added to the well-mixed starter mash which should have a minimum temperature of 25° C.

The aerator is turned on, the valve for the circulating air is opened completely to reduce alcohol loss, and the temperature of the starter mash is raised to abt. 30° C, which corresponds to the fermentation temperature. If after 2 - 5 days the acidity of the fermenting liquid increases, the pipe for the circulating air is closed again. The bacteria start to multiply, and the fermentation speed as well as the acidity go up, while the alcohol concentration decreases.

There are two ways to produce low-strength cider vinegar, either in a continuous or in a batch-wise process:

- a) In the continuous process a quantity of denatured cider which corresponds to the production capacity of the Acetator is continuously added into the Acetator. The flow rate is controlled by the degree of residual alcohol in the discharged vinegar. As the alcohol concentration of the fermenting liquid can be analysed and registered continuously and automatically by means of the Acetomat III in combination with the Alkosens IIa, it is possible to regulate the flow rate of the cider in such a way that the discharged vinegar contains no more than 0.3% of residual alcohol.
- b) In the batch-wise process, the fermentation is run down to a residual alcohol concentration of 0.2% - 0.3%. Subsequently, the Acetator is emptied to about half of its contents, and it is then automatically refilled with fresh, denatured cider. The bacteria which remain in the Acetator after discharge, inoculate the new batch, so that there is no lag phase during fermentation.

In both production methods, the Acetator runs practically automatically and without supervision, until the cider has been completely fermented into cider vinegar.

High-Strength Cider Vinegar

This term is used for cider vinegar with more than 9% and up to 13% total concentration. The fermentation resembles spirit vinegar fermentation because high concentrations of alcohol and acetic acid require the addition of complex nutrient mixtures such as Frings

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nutritive salt.

To start such a fermentation, vinegar from a high strength alcohol vinegar or a high strength cider vinegar fermentation should be used as inoculum. The Acetator is half filled with inoculation vinegar of 7-7.5% acidity and 4.5-5.5% alcohol. As bacteria nutrient, Frings nutritive salt in a concentration of 0.4 grams per liter is added. (The dosage of Frings nutritive salt for wine or cider fermentations is 0.1 - 0.4 grams per liter, depending on the quality of the wine to be fermented. The user should find out for himself the ideal quantity, beginning with 0.4 g/l and going down as much as convenient in dependence of the fermentation rate.)

The remaining fermentation procedure is much the same as that described for low strength fermentation. Acidification normally starts some 5 - 10 days after turning on the aerator and bringing the fermenting liquid to the desired temperature.

A continuous process for high strength fermentations is not recommended, as the rate of multiplication of the bacteria decreases with increasing acidity, thereby reducing the fermentation rate proportionally.

Filtration

Self-clarification by sedimentation depends on acidity. Cider vinegar of low acidity normally does not clear even after long storage, while high strength cider vinegar usually does within a couple of months.

For an economical filtration of fruit and wine vinegar we recommend the Frings crossflow microfiltration plants. With these plants, high filtration rates and product yields are obtained for a satisfactory length of time. All valuable substances as well as the color of the wine are preserved, and the result of filtration in only one filtration step is a bacteria-free product.

Cider vinegar may also be filtered in a kieselguhr disk filter, and if no filter at all is available, coagulation with a fining agent such as the Frings product "Fribenton" will equally lead to satisfactory results. The ideal quantity of fining agent to be added depends on the cloudiness of the vinegar and can be found out by the customer himself in occasional tests. Fining has the additional advantage of stabilizing the vinegar, so that no deposits will settle during storage in bottles.

Before the clear cider vinegar is filled into bottles it is usually pasteurized and treated in a candle filter.