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Brennereitechnologie

# Alternatives to the use of formalin

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**- in the production of distilling mashes from grain and potatoes -**



Formalin, an approximately 36% aqueous solution of formaldehyde, was widely used for decades in grain and potato distilleries as an inexpensive disinfectant.

There were good reasons for this:

Previously common mashing processes worked exclusively with fresh green barley malt or dried barley malt as a source of saccharification enzymes, which are necessary for breaking down the starch in the raw material.

However, due to its production conditions, malt always contains microorganisms, especially bacteria, which can get into the grain and potato mashes together with the malt and cause damage there.

Due to its heat- and acid-sensitive enzyme activities, malt must not be exposed to temperatures of more than 55-60°C and pH values of no more than 5.5 during the mashing process. As most bacteria survive under these conditions, malt poses a considerable risk of infection for otherwise perfectly prepared mashes. The bacteria introduced into the mash multiply within a few hours and cause severe malfermentation ("souring") and often considerable yield losses.

**Formalin used to have its place here:** As the yeast required for fermentation is less sensitive to formaldehyde than bacteria, the addition of 20-25 mL of formalin per hL protected the freshly prepared mash against bacterial spoilage for the first few hours of fermentation without impairing fermentation. The disinfection of the separately stirred malt mash was particularly effective with the help of the correspondingly higher dosage of formalin.

**Formalin is no longer available over the counter due to its harmful properties for humans.** In addition, it is no longer permitted for the purpose of disinfecting distilling mashes, as modern mashing processes can dispense with formalin without any disadvantages.

Since industrially produced heat- and acid-stable liquid enzymes have also become available for the liquefaction and saccharification of vegetable starch in distilleries, cereal malt is no longer an important source of enzymes.

Nevertheless, malt has remained an important raw material for distillation: On the one hand, the 15 % malt, which is mashed together with 100 % raw fruit cereals in the malting distillery, results in an alcohol tax-free additional yield. On the other hand, malt is an important component of raw material mixtures for the production of whisk(e)y, as a valuable carrier of malt, kilned, roasted and smoky aromas.

**How can infection-free mashes be produced without formalin?**

Modern mashing processes for starchy raw materials combine thermal disinfection of the entire raw material mixture with acid protection similar to pasteurization, as is known from canned fruit or vegetables.

**In detail, this means:**
The entire raw material (raw fruit grain and grain malt) is mashed with warm or hot water, the mash is immediately provided with a heat-stable α-amylase **("Schliessmann VF" or "Schliessmann VF potato")** and kept at temperatures of at least 70°C (at least 90°C for potatoes, maize, rice and millet) for at least 30 minutes. This liquefaction rest has two objectives:

- The starch in the raw material mixture is completely dissolved and enzymatically pre-crushed (gelatinization and liquefaction, "dextrinization").
- Although the high temperature inactivates the enzymes in the malt, it also reliably kills all living bacteria.

The mash is then cooled to saccharification temperature (55°C).

**Sulphuric or PM acid** (acidification to pH 4.5-4.7) and an acid-stable glucoamylase **("Schliessmann VZ")** are then added with the following effects:

- Acidification offers additional protection against bacterial infections, as it prevents the "germination" of heat-resistant bacterial spores.
- The liquid enzyme not only replaces the missing malt enzymes for saccharification, but also saves the otherwise necessary saccharification rest.

This enables immediate further cooling to pitching, i.e. fermentation temperature. The following two measures provide additional protection for the fresh mash against harmful bacteria:

- The use of a dry pure yeast (e.g. **Kornbrand premium / Whiskey select**) instead of fresh baker's or brewer's yeast: The dry yeasts mentioned are more alcohol-tolerant and contain fewer lactic acid bacteria than fresh yeasts due to the production process.
- Fermentation in the mash tun eliminates the risk of infecting the fresh mash with bacteria through unclean hoses or pumps when transferring it to a fermentation tank.