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Amygdalin - hydrocyanic acid- Cyanide - Ethyl carbamate

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Brief description of the chemical connections

The stones of cherries, plums, prunes, mirabelles, apricots, peaches, sloes and other stone fruits contain 2-8% **amygdalin**, a combination of **glucose**, **benzaldehyde** and **hydrocyanic acid**. Benzaldehyde, colloquially also known as bitter almond oil, causes the stone-flavored taste, which is typical of brandies made from these fruits, reminiscent of bitter almonds or marzipan. Pome fruit kernels also contain small amounts of amygdalin. Those who chew an apple seed experience the same typical taste impression.
Hydrocyanic acid is a toxic liquid.
Amygdalin is broken down into these three components during the fermentation and storage of the mash, catalysed by enzymes that are also present in the stones. This means that undesirable amounts of hydrocyanic acid, but also benzaldehyde, are released into the mash, especially from cracked stones and during long storage periods. Both substances are volatile and pass into the distillate during distillation.
Since, under the distillation conditions customary in fruit distilleries, it is not possible to enrich hydrocyanic acid in the first or last fraction in order to obtain a heart (middle) fraction with a low hydrocyanic content, it is only possible to bind it in the distilling apparatus or the distillers wash.
On the one hand, this is done on clean, bare copper surfaces, especially the large-area catalysts with which modern distilling apparatus are equipped.
On the other hand, it is possible to work according to the patented CYANUREX®process. The user acquires the right to use this patent by purchasing CYANUREX®, a highly effective copper-containing salt which is added to the mash directly before distillation and binds hydrocyanic acid as a non-volatile copper cyanide during distillation.

Without these measures, the "free" hydrocyanic acid present in the freshly distilled distillate combines within a few days with other distillate constituents to form "bound" hydrocyanic acid, so-called **cyanides**. These cyanides turn into **ethyl carbamate** (EC), a toxic, carcinogenic and thus also undesirable compound, during storage of the distillate or the reduced brandy. This reaction starts with a single exposure to light on the distillate and continues until all cyanides are used up.
In contrast to hydrocyanic acid, EC can be enriched in the tails (last fraction). With the right distillation conditions, it is possible to obtain flawless middle fractions from EC-containing distillates and spirits by re-distilling. However, measures to bind hydrocyanic acid must almost always be applied to, as cyanides are usually present in addition to EC.

For carcinogenic substances such as EC, it is not possible to establish a no-effect-level at which health risks can be excluded. This obliges each spirits producer and distiller to use all technical and craft possibilities to reduce the concentrations of EC or cyanides in its products.

This objective presupposes that cyanide can be detected quickly and reliably.

The **Schliessmann CYANID-Test** is a quick and easy test for estimating the natural cyanide content in stone fruit distillates. The test allows only a relatively rough classification of the cyanide content in the concentration levels 0,1,3 and 30 mg/litre of the sample, but it is still easy to see whether the critical threshold of 1 mg/l has been exceeded or not. If a more precise determination of higher concentrations of cyanide is required, the somewhat more complex CyanoQuant test should be carried out or a specialist laboratory commissioned. EC can only be measured in the laboratory using gas chromatography.

The **CYANID test** can be carried out in two ways:
In distillates that are examined immediately after distillation, the "**Determination of the free cyanide**" procedure is followed. In the case of distillates already stored for several hours and purchased distillates, the procedure described in the "**Determination of the total cyanide**" manual is followed.

Schliessmann CYANID test in freshly distilled distillates (also test distillates from mash samples)

Since re-distilling processes always mean losses of time, energy and cooling water, but above all aroma deterioration, it is advisable to obtain cyanide-free distillates already during mash distillation.

In fresh test distillates of the mash or in the first distillate of a larger batch of mash, the determination of the **free cyanide** makes it possible to make arrangements for the reduction of the hydrocyanic acid content at the next distillation.
Distillates with a cyanide content of more than 1 mg/l should be stored in absolute darkness immediately to prevent formation of EC.

Important: Free cyanide is bound after just a few hours and can only be determined by determining the total cyanide.

Schliessmann CYANID test in stored and purchased distillates from own or foreign production

Stored distillates and purchased distillates may contain not only free and bound cyanide but also EC. They should therefore only be placed on the market if it is ensured that the total cyanide content is less than 1 mg/l and the distillate has always been stored in the dark; otherwise there is a risk that EC has already been formed.
For this reason, distillates with "unknown prehistory" should, even if they do not contain cyanide, always be examined for their EC content in the specialist laboratory or re-distilled in order to separate existing EC via the last fraction.
Distillates with a total cyanide content of more than 1 mg/l should not be placed on the market but re-distilled in a clean still.
If the total cyanide content exceeds 3 mg/l, the CYANUREX® or catalyst process should also be used for re-distillating.