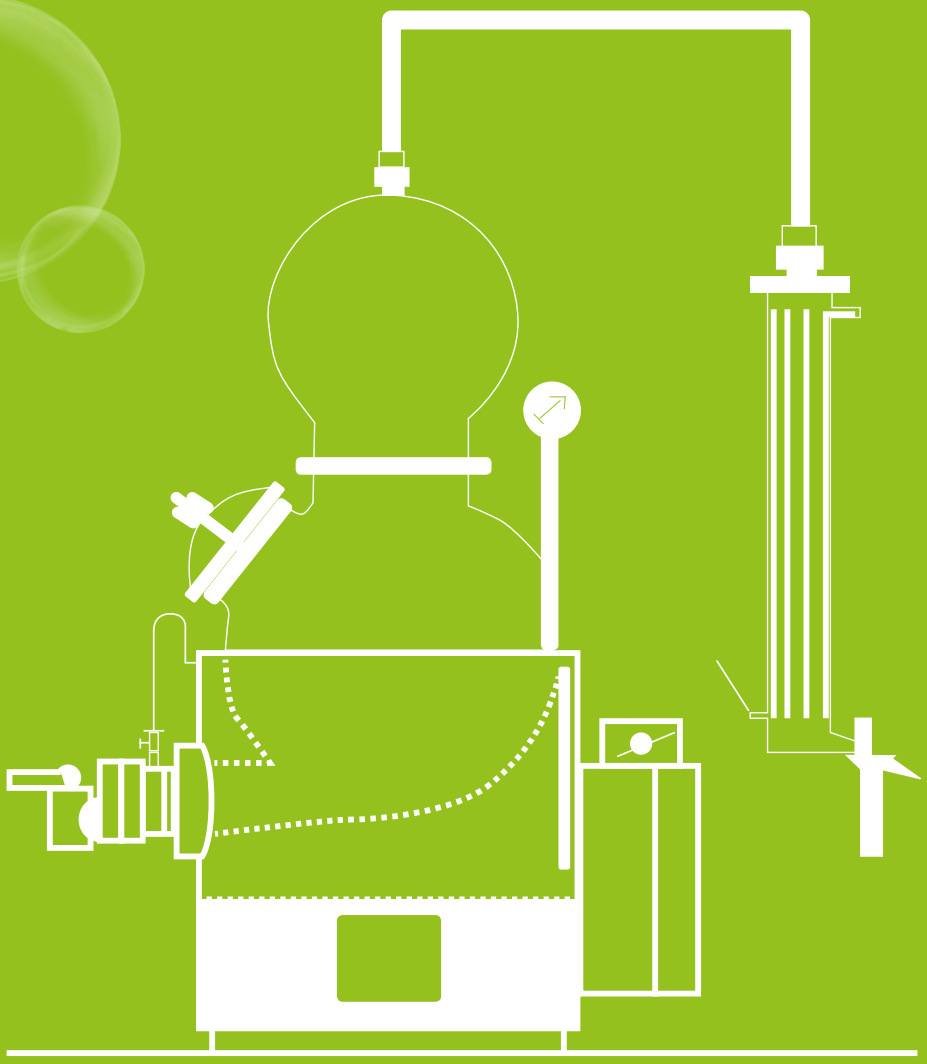
Distillation Guide



Fruit and grain distillation

- Fermentation
- Enzymation
- Various processing tables

ERBSLÖH

Progress is our future

Yeast and enzymes in the distillery

Aims of fermentation using pure yeasts:

- **Greatest possible alcohol yield**
- **Retention of fruit aroma, "clean" fermentation**
- **Suppression of secondary flora (bacteria, wild yeasts)**

Correct use of yeast:

- **Rehydrate in luke warm water (37–42 °C)**
- **Check for vitality (foaming) after 10-15 minutes**
- **Stir into the mash within 30 minutes**
- **Dilute 1:1 with mash at low mash temperatures (< 20 °C)**

As a rule pure yeasts for alcoholic fermentation are selected from wine yeasts and habituated to higher alcohol contents through targeted adaptation. All Erbslöh® yeasts ferment to at least 12% ABV in appropriate fermentation conditions. If the supply of nutrients is good, high-performing yeasts such as Spiriferm Arom can generate 15% ABV and more.

Different yeast strains vary with regard to formation of fermentation by-products (volatile alcohols, esters), how they behave during fermentation and tolerance to unfavourable external conditions (low temperatures, poor nutrient supply). The latter is particularly marked in Bayanus-type fermentation yeasts. Some yeasts have higher glycosidic enzyme activity and are therefore able to split off bonded aromatics (e.g. terpenes). These are known as bouquet yeasts.

Characteristics of yeasts

Yeast	Spiriferm Arom	Spiriferm Classic	Spiriferm	Oenoferm® Freddo	Oenoferm® C2
Yeast	Cerevisiae	Cerevisiae	Cerevisiae	Bayanus	Cerevisiae
Fermentation behaviour	Fast and safe	Moderate but continuous	Rapid under normal conditions	Slow start, then fast and safe	Fast and even
Formation of volatile additional constituents	High	Moderate	High	Slight	Slight
Specifics	Glycosidic activity, bouquet yeast	None	None	Low foaming, retains acidity	None
Nutrient requirement	Moderate to high	Moderate	Moderate	Slight	High
Recommended fermentation temperature	18–25 °C	18–25 °C	16–22 °C	14–20 °C	20–30 °C
Alcohol tolerance	Up to 15% ABV.	Up to 12% ABV.	Up to 14% ABV.	Up to 15% ABV.	Up to 17% ABV.
Recommended for	Yellow stone fruit, grapes, pomace	Pome fruit, cherries, grain, molasses	Any fruit	Berries, Williams pears, wild fruit	Grain, potatoes, molasses

Yeast nutrition

Various preparations are available to adequately supply the yeast with nutrients. The addition of 25–40 g Vitamon® Combi (diammonium phosphate + thiamin) to 100 kg fruit is recommended for guaranteed final fermentation. German small/home distillers must not use yeast nutrients because of duty law.

Cold fermentation in the fruit distillery

Fermentation below 20 °C is known as cool fermentation, fermentation below 15 °C is cold fermentation. The temperature should not fall below 12 °C, even for cold fermentation. The risk of stuck fermentation is too high. Delayed or interrupted fermentation usually impairs yield and aroma. This raises questions about the positive effect of cold fermentation. Cold fermentation makes sense if delicate berry, Williams pear or wild fruit aromas are to be protected before discharge by significant CO_2 formation during "turbulent" fermentation.
This effect is helped by the use of a Bayanus yeast such as Oenoferm® Freddo. It is very tolerant where temperature is concerned and its fermentation behaviour promotes moderate CO_2 formation.

The following stages must be adhered to for guaranteed fermentation:

- Increase yeast dosage to 20-25 g/100 kg mash
- If possible, use yeast nutrient (25–40 g/100 kg Vitamon® Combi)
- Monitor fermentation progress daily, reduce cooling if fermentation slows

The fermentation tank must only be cooled during the first fermentation phase (2-3 days). Thereafter the speed of fermentation self-regulates at a moderate level. Continuous cooling would be counter-productive. Attention must be paid to thorough mixing when providing external cooling by exposing the tanks to a stream of water, as temperatures inside can far exceed 20 °C.

Enzymes

Enzymes are proteins which act as biocatalysts because of their structure. This special property ensures that certain biochemical reactions can be accelerated or elapse. Metabolic and digestive functions would not work without enzymes. There are also enzymes obtained from bacteria or moulds through fermentation, in addition to the enzymes which work naturally in organisms. They are used in many ways, such as in food production, in detergents and leather processing. On the one hand enzyme activity depends on the degree of concentration, on the other on external factors such as the pH value and temperature. As proteins, enzymes are denatured at high temperatures and lose their efficacy as a result. It is therefore important for the desired processes to meet a specific pH and temperature range at which the enzymes are correspondingly effective. As a rule, enzymes are used in beverage production to support the fruit's own enzymes for a faster biochemical process.

1. Amylases (starch-degrading enzymes)

Nowadays amylases are used almost exclusively in grain and potato distillation instead of malt (pre-treated grain with high enzyme activity), to liquefy and saccharify raw materials containing starch. Compliance with a suitable temperature cycle is necessary for optimum degradation. Only on this condition is it possible to achieve maximum saccharification of the starches in the enzymated mash and therefore achieve the optimum yield. Incomplete starch degradation results in a reduced yield. In fruit distillation, amylases are used as a supplementary enzyme when processing starchy fruits (e.g. apples).

2. Pectinases (enzymes which degrade pectins)

Pectins provide the skeleton in fruit and are therefore present in virtually all types of fruit.

Pectin in fruits

Fruit variety	Pectin content in % by:		
	Fresh tissue	Dry mass	Proportion of sugar
Apple	0.6	3.8	5.4
Pear	0.5	2.9	5.1
Apricot	1.0	7.9	16.4
Sweet cherry	0.3	1.6	2.4
Plum	0.9	6.4	11.5
Blackberry	0.7	3.7	14.0
Raspberry	0.4	2.9	8.9
Blackcurrant	1.1	5.6	17.5

Source: Belitz/Grosch, Lehrbuch der Lebensmittelchemie

Apricots, plums and blackcurrants have the highest absolute pectin content. Where sugar content is concerned, fruits such as blackberries and raspberries have a higher pectin content than apples and pears. This can cause increased methanol content in the distillate.

Due to different pectin contents and pectin branching, the need for pectolytic enzymes varies depending on the fruit and degree of maturity. Fruit softening during ripening indicates the action of enzymes naturally contained in the fruit. Especially in the case of fruit placed in cold storage for a long time, the fruit's own enzyme activity is no longer sufficient to ensure adequate liquefaction of the mash. Low viscosity mashes facilitate efficient processing and offer numerous other advantages:

- **Better additive distribution (acid, yeast, fermentation salt) promoting faster onset of fermentation**
- **Low blanket formation, less expansion space required**
- **Better pumpability - no dilution required**
- **Optimum heat transfer during distillation**

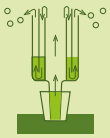
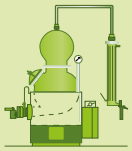
3. Beta-glucosidases (aroma enzymes)

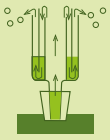
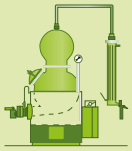
Glycosidic enzymes split bonded aromatics from saccharide residues. ß-glucosidase, which in particular splits off terpenes, is interesting. This group of aromatics occurs in low concentrations in grapes from aromatic grape varieties (Muscatel, Gewürztraminer) and in yellow stone fruits (apricots, mirabelle plums), but in these low volumes helps to intensify the aroma. They also release aromas from the phenol group (e.g. eugenol) from berries and stone fruits (plums), which contribute to a more complex aroma.to a more complex aroma.

Correct use of enzymes

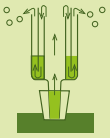
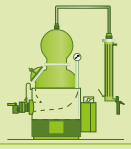
Enzymes work best in optimum pH and temperature ranges. These conditions (pH 4-5, T = 40-50 °C) are not helpful in terms of clean, aroma-preserving fermentation. Ideally enzymation takes place before acidity and yeast are added, so the conditions present are almost ideal. Enzymatic liquefaction takes place within 3-4 hours for fruit harvested warm and at the natural pH value. After acidification to pH < 3 and possible cooling, fermentation can then be induced by vaccination with yeast and, if necessary, with nutrients. The fermentation tanks must be equipped with an agitator so the acid and starter yeast can be mixed in. If an agitator is not available, the enzymes can be added with the other additives during mashing-in. A comparable liquefaction effect can therefore be achieved through an increased quantity (20-30% more) and a suitably extended reaction time. The mash temperature should not fall below 15 °C.

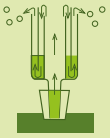
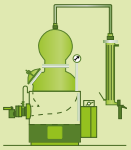
Fruit distillery processing table

	Berry fruit (e.g. raspberries, blackberries, rowan berries)		
	Processing stages	**Products used**	**Recommended dosage**
Raw material 	Removal of damaged and rotting fruit, thorough cleaning		
Mashing-in 	Crushing with roller mill or stamper	Distizym® FM	20–30 mL/100 kg fruit, up to 50 mL for blackcurrants
	Acidification to pH 2.8–3.0	Erbslöh® pH-Senker	2–3 L/100 kg fruit
Fermentation 	Normal fermentation at 20–25 °C	Spiriferm	15–20 g/100 kg fruit
	Cool fermentation at 18–20 °C	Oenoferm® Freddo	20–25 g/100 kg fruit
	Nutrient additive*	Vitamon® Combi	30 g/100 kg fruit
Distillation 	Distil off immediately after end of fermentation, gentle, slow distillation	Erbslöh® Schaum-ex	2–4 mL/100 L mash
Storage 	Protect from light in inert materials (glass, stainless steel) at temperatures < 20 °C	Harmonisation and removal of ethanol notes with DistiPur	20–30 g/100 L distillate

	Pome fruit (e.g. apples, pears, quinces)		
	Processing stages	**Products used**	**Recommended dosage**
Raw material 	Removal of damaged and rotting fruit, thorough cleaning, removal of leaves		
Mashing-in 	Chop with a roller mill or shredder, chop quinces using a mixer with a chopping attachment	Distizym® FM-TOP	5–10 mL/100 kg fruits, up to 20 mL for quinces
	Acidification to pH 2.8–3.0	Erbslöh® pH-Senker	2–3 L/100 kg fruit
Fermentation 	Normal fermentation at 20–25 °C	Spiriferm Classic	15–20 g/100 kg fruit
	Cool fermentation at 18–20 °C	Oenoferm® Freddo	20–25 g/100 kg fruit
	Nutrient additive*	Vitamon® Combi	30 g/100 kg fruit
Distillation 	Distil off soon after end of fermentation, gentle, slow distillation	Erbslöh® Schaum-ex	2–4 mL/100 L mash
Storage 	Protect from light in inert materials (glass, stainless steel) at temperatures around 20 °C, strong apple brandies can be stored in wooden barrels	Harmonisation and removal of musty notes with DistiPur	30–60 g/100 L distillate

* Not permitted in German home/small-scale distilleries.

	Stone fruit (e.g. cherries, marille plums, plums, sloes)		
	Processing stages	**Products used**	**Recommended dosage**
Raw material 	Removal of damaged and rotting fruit, thorough cleaning, removal of leaves		
Mashing-in 	Crushing with roller mill or stamper, no damage to the stones if possible	Distizym® FM	20–30 mL/100 kg fruit, up to 50 mL for apricots
		Trenolin® Bouquet^{Plus} for yellow fruit	5–10 mL/100 kg fruit
	Acidification to pH 3.0-3.2	Erbslöh® pH-Senker	1–2 L/100 kg fruit
Fermentation 	Normal fermentation at 20–25 °C	Spiriferm Arom	15–20 g/100 kg fruit
	Cool fermentation at 18–20 °C	Oenoferm® Freddo	20–25 g/100 kg fruit
	Nutrient additive*	Vitamon® Combi	30 g/100 kg fruit
Distillation 	Distil off at the latest 1-2 months after end of fermentation, gentle, slow distillation	Erbslöh® Schaum-ex	2–4 mL/100 L mash
Storage 	Protect from light in inert materials (glass, stainless steel) at temperatures around 20 °C, strong plum brandies can be stored in wooden barrels	Harmonisation and removal of pungent notes with DistiPur	30–60 g/100 L distillate

	Grapes and marc (e.g. Gewürztraminer, Muscatel)		
	Processing stages	**Products used**	**Recommended dosage**
Raw material 	Removal of damaged and rotting fruit, thorough cleaning		
Mashing-in 	Press using a grape press, wet dry marc	Distizym® FM-TOP	2–3 mL/100 kg grapes, up to20 mL/100 kg for marc
		Trenolin® Bouquet^{Plus} for aromatic varieties	5–10 mL/100 kg fruit
	Acidification to pH 3.0-3.2	Erbslöh® pH-Senker	1–2 L/100 kg fruit
Fermentation 	Normal fermentation at 20–25 °C	Spiriferm Arom	15–20 g/100 kg fruit
	Cool fermentation at 18–20 °C	Oenoferm® Freddo	20–25 g/100 kg fruit
	Nutrient additive*	Vitamon® Combi	30 g/100 kg fruit
Distillation 	Distil off at the latest 1-2 months after end of fermentation, gentle, slow distillation	Erbslöh® Schaum-ex	2–4 mL/100 L mash
Storage 	Protect from light in inert materials (glass, stainless steel) at temperatures around 20 °C, strong marc brandies can be stored in wooden barrels	Harmonisation and removal of pungent notes with DistiPur	30–60 g/100 L distillate

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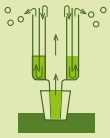
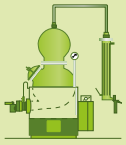
Whisky/vodka processing table

Grain processing diagram	Barley, wheat, rye, corn		
	Processing stages	**Products used**	**Recommended dosage**
Mashing-in 	Mashing-in at 45 °C for a 1:3 ratio of grit to water, 1:5 for corn		
	Malt	CraftZYM opal	20–40 mL/100 kg grit
	Barley, wheat, rye, corn	CraftZYM opal	20–40 mL/100 kg grit
		CraftZYM ruby	10–20 mL/100 kg grit
Gelatinisation and hydrolysis 	Slowly heat malt, barley and wheat to 65 °C, stop after 2.5–3 hours		
	Rye Slowly heat to 70 °C, stop after 2.5–3 hours		
	Corn Slowly heat to 80 °C, stop after 2.5–3 hours		
Saccharifi-cation 	Cool down to 60 °C and rest the enzymes for 1–2 hours	CraftZYM quartz	10–20 mL/100 kg grain
Fermentation 	Cool down to fermentation temperature		
	Rapid fermentation at 35 – 40 °C	Oenoferm® C2	20–30 g/100 L mash
		Vitamon® Combi*	30–50 g/100 L mash
	Normal fermentation at 20–25 °C	Spiriferm Classic	20–30 g/100 L mash
		Vitamon® Combi*	30–50 g/100 L mash
Distillation 	Distil off soon after end of fermentation, gentle, slow distillation	Erbslöh® Schaum-ex	2–4 mL/100 L mash
Storage 	Whisky Adhere to compulsory length of barrel maturation		
	Vodka Harmonisation and neutralisation	DistiPur and/or Granucol® GE	30–60 g/100 L distillate 200–500 g/100 L distillate

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Product	Description	Application	Dosage (g or mL per 100 kg/L)
Spiriferm Arom	Bouquet yeast	Fermentation of yellow stone fruit, grapes, pomace	15 - 40
Spiriferm Classic	Dry selected pure yeast	Pome fruit, cherries, grain, molasses	15 - 40
Spiriferm	Dry selected pure yeast for rapid fermentation	Any fruit	15 - 40
Oenoferm® Freddo	Cold fermentation yeast	Difficult fermentation conditions, berries, Williams pears and wild fruit	20 - 40
Oenoferm® C2	Alcohol-tolerant yeast	Grain distillery, molasses	20 - 40
Distizym® FM	Enzyme for liquefying distillery mashes	Berry fruit, stone fruit	20 - 50
Distizym® FM-TOP	Enzyme for liquefying distillery mashes made from hard fruit	Pome fruit, stone fruit, tubers/roots, Jerusalem artichoke	5 - 50
Trenolin® Bouquet^{Plus}	Aroma enzyme	Release of bonded glycosidic aromas, muscat grape, stone fruit	5 - 10
CraftZYM opal	Bacterial alpha-amylase	Starch gelatinisation and liquefaction in the mash	20 - 40
CraftZYM quartz	Highly concentrated glucoamylase	Starch saccharification	10 - 20
CraftZYM ruby	Fungal pentosanase and beta-glucanase	Viscosity reduction in grain mashes	10 - 20
Vitamon® Combi	Diammonium phosphate + thiamin	Yeast nutrition	25 - 40
Erbslöh pH-Senker	Liquid acid combination	Acidulation of distillery mashes	1,000 - 3,000
Erbslöh Schaum-ex	Silicon defoamer	Avoids foam forming during fermentation and distillation	2 - 80
DistiPur	Mineral adsorbent	Harmonises bouquet in finished distillate	20 - 70
Granucol GE	Granulated activated charcoal	Removal of off notes and flavours, production of neutral alcohol	10 - 500
OakyVin AM/AH	American oak chips, heavy and medium toasted	Improved mouthfeel and enhanced aroma spectrum	See product data sheet for details
OakyVin FM/FH	French oak chips, heavy and medium toasted	Improved mouthfeel/flavour profile; barrel storage	See product data sheet for details