

Dealcoholisation plants for beer and wine

Make yourself accessible to new groups of customers with new smart products

Alcohol free beverages - a growing market for good beer

The market for beer which contains alcohol is very limited and it is becoming ever smaller. Typical beer drinkers only constitute a negligible section of the population. Many people limit their beer consumption in order to lose weight, to drive a vehicle or to remain competitive in their profession. 50% of the population, namely women, have not really acquired a taste for beer. Alcoholic drinks are not available for sale in many parts of the world due to the prevailing local ideologies. Groups from these countries are becoming more numerous elsewhere as well. A brewery will find that perhaps 70% of the total population will not become potential customers. For the remaining 30% beer is often just a beverage for a special occasion. These would be regarded as very poor parameters if a market analysis for beer was ever undertaken.

On the other hand the production of alcohol-free beer does present new opportunities. The potential for new customers is huge. It is possible to imagine beer (of the alcohol-free variety) being customary at the workplace for the first time since the 1960s.

The market for alcohol-free beer is growing steadily but not yet to its full potential. This is due to the fact that while all breweries have an acceptable strong beer in their range, an extraordinarily low number have so far introduced convincing alcohol-free beers onto the market. It is necessary to experiment a lot in order to find a satisfying alcohol-free beer. Most people do not go to such trouble and are also very unforgiving if they didn't like a particular product. It would be very difficult, if not impossible, to convince such people to return to that brand. The motto should be: Either a really good alcohol-free beer or none at all.

Our plants will help the master brewer to develop an extremely good alcohol-free beer. From the point of view of the process, our plants differ from competing plants which we are familiar with as the customer can adapt the plant parameters such as temperature, evaporation pressure and even different treatment times without the complete process becoming unstable.

System comparison

In addition to the prevention of the formation of alcohol in the fermentation process, there are two beer related processes for dealcoholisation of the finished product. These are membrane filtration and thermal processes (thin film evaporation). Flavouring sources such as ester and higher alcohols escape during both processes. The flavouring sources are discharged with the permeate in the membrane process and with the vapour in the thin film evaporation process.

Our systems are based on the thin film evaporation process. This process enables a residual alcohol content of 0.0% (0.09%) to be easily achieved. This is not on the other hand so straightforward with membrane filtration. Why should a brewery rule out the markets where there is a 0.0% limit from the outset? Systems based on thin film evaporation are also very flexible with regard to the products to be treated (yeast clouded beers can also be dealcoholised) and it is much easier for the user to experiment with beer types and flavouring sources to develop the best possible product. The following measures are described in the literature:

- Addition of beer flavours which are extracted from residual yeast.
- Use HG beers for dealcoholisation (beers which were fermented with a higher original gravity).
- Use beers for dealcoholisation which were started at higher temperatures and with less oxygen (fermentation).
- If 0.5% alcohol per volume is permissible, beer can be dealcoholised to 0.0% alcohol per volume and then blended with a very strong-flavoured beer.
- There are additional possibilities for a fuller bodied taste if the brewing process is not fully in line with the German Purity Law.

The system consists of the following essential assemblies. A source tank and a target tank. A “routing module” on which a multi-level heat exchanger, the control and several valve combinations are located. One or more column modules on which the vacuum pump, the product pump and the hot water circuit for the respective column are also located.

Process description

Only the following measures are necessary to remove the ethanol from a water-ethanol mixture:

- Bring the mixture to a low boiling point. The ambient pressure must be reduced for this purpose. As the reduction in pressure must be undertaken with a liquid ring vacuum pump (suction of the vapour), the achievable vacuum is limited to an absolute pressure of approx. 35 mbar (1mbar = 1 hPa).
- Spread the mixture over a surface as a thin film so that even evaporation can take place there.
- If an evaporation rate of 40% of the mixture is achieved under these conditions, then only 0.5% alcohol will remain in the treated product if an initial alcohol content of 5% is assumed for the beer.
- Our systems also make use of rectification. In the rectification process water vapours are guided over a thinly applied product film. The water vapour strips the alcohol from the product film and enriches itself with alcohol.

Boiling points as a function of pressure

	Water	Ethanol
1000 mbar (ambient pressure)	99,6°C	78°C
500 mbar	80,9°C	60,4°C
300 mbar	68,3°C	48,6°C
250 mbar	64,0°C	44,6°C
200 mbar	58,9°C	39,8°C
150 mbar	52,5°C	33,9°C
100 mbar	44,0°C	25,8°C
50 mbar	30,3°C	13,0°C
40 mbar	26,2°C	9,2°C
30 mbar	21,0°C	4,3°C
20 mbar	14,0°C	-2,3°C

The following processes must take place for the product in our dealcoholisation plants: 1. Degassing, 2. Heating, 3. Dealcoholisation, 4. Cooling, 5. Thinning and 6. Carbonation. Our plant functions as a combination of continuous and batch processes. The continuous processes enable a high degree of heat recovery while the batch processes facilitate results which would not be achievable with a purely continuous process.

Quality of the dealcoholised beer

What is a dealcoholised beer's ability to meet high taste requirements dependent on? As stated previously, the system must make it possible for the master brewer to change all process parameters freely without the system becoming unstable. Plants where the complete process only runs continuously do not allow this. Changing a process parameter could easily result in the process collapsing there. For example temperatures cannot be changed because the vapour from the product is used for heating the next column but a certain minimum temperature is still required there.

There is a process specific effect on the product quality regardless of the adaptability of our plant. This can be clearly seen in a comparison of flash pasteurisers (our main product) with tunnel pasteurisation systems. The pasteurised product from the flash pasteuriser is clearly superior to the product from the tunnel pasteuriser in terms of taste. It is primarily the treatment time at effective temperature which makes the difference. Our plants are therefore designed in such a way that each part of the product is exposed to the same short, intensive treatment. The product is not treated slowly in different process stages and it is instead just exposed to the maximum effect briefly and then cooled back down immediately. The thin film evaporation therefore occurs in the highest possible falling film evaporators in our products. This is the only way in which it can be ensured that the complete product is treated evenly and that it flows through the evaporator quickly. The higher the column, the greater the active surface which is available in a stage.

Typical thermal systems for dealcoholisation which are available on the market keep the beer at its treatment temperature for a long period. Our approach involves exposing the beer to the treatment temperature just for the period of immediate treatment in the column (a few seconds).

Flavour-Recovery

Unfortunately a large part of the product flavour is lost during the dealcoholisation process and it should be recovered as fully as possible. Our flavour recovery process makes use of the fact that the substances which contribute to the flavour, which can be recovered with a reasonable effort, are largely still more volatile than the alcohol itself. That is actually an aggravating factor but it is only through this that flavour recovery is made possible in our system.

Climate-Impact

Carbon dioxide (CO₂) is removed from the beer during the dealcoholisation process. This CO₂ is released into the atmosphere in most competing plants. Our plants can be equipped with an assembly for recovering the carbon dioxide. A significant proportion of the carbon dioxide is recovered, which also makes the recovery commercially beneficial.

Alcohol-Concentration

The alcohol which accumulates during the dealcoholisation process remains in the evaporated water. This ethanol-water mixture is condensed and it can be sold to alcohol producers. The higher the concentration of alcohol, the higher the sale price which can be obtained. Our dealcoholisation plants can concentrate the alcohol very intensively if this is desired. The best solution for an individual case depends on the production quantity.

OPTIONS

Sizes

One advantage of our plants is that they can be extended in a modular fashion. The plant has one or two further column modules added for this purpose. The new column module contains all the appliances necessary for operation (vacuum pump, product pump, hot water circuit). The heat exchanger of the routing module is equipped with additional plates in the event of an extension. It is possible to achieve a residual alcohol content of 0.0% with each plant. The following sizes are provided:

Basic module	Throughput rate	Throughput rate in max. final extension
Type 25	500 litres/h	3.500 litres/h
Type 40	2.000 litres/h	9.000 litres/h
Type 50	4.000 litres/h	14.000 litres/h

Special versions

On the other hand it is not necessary to have every function at the start; this makes a cost-effective start possible. The flavour recovery, CO2 recovery, the alcohol concentration or a sophisticated process control system (e.g. ProLeiT or BRAUMAT) with comprehensive process data recording can be fitted at a later stage. The plant can be supplied with an integrated CIP system or an integrated flash pasteuriser for subsequent pasteurisation.

We take care of the complete process. This is the case even if we are only responsible for the dealcoholisation plant. Customers can rest assured that we leave nothing to chance.

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