

VINEGAR

Freeze Concentration of Vinegar



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Application

Freeze concentration is a crystallization technology applied in the food industry for the concentration of aqueous (food) liquids. Freeze concentration converts part of the water into ice that is then removed from the liquid (concentrate). The technology is applied in a wide range of products, mainly in the premium segment (like juice-, coffee- and dairy products) mainly in the premium segment. Freeze concentration is a gentle concentration method that ensures retention of flavors and volatile components, resulting in premium quality concentrates. Freeze concentration is also used in other industries where more traditional concentration technologies have their limitations (e.g. in alcoholic beverages) or in bulk production, like vinegar, because of its reliable and continuous way of operation.

Concentration by crystallization is a well-known process within the vinegar industry. When concentration is applied, it is often done in a batchwise mode by using (multiple) static freezers. This is a relatively simple process, but due to long batch times, high energy consumption and losses of vinegar in the discharged water, it does not meet the sustainable requirements that producers have nowadays. GEA Niro PT offers a reliable, continuous and sustainable alternative by its IceCon® technology. The system contains a low number of rotating equipment, keeping maintenance costs low. Leading parameters for the concentration of vinegar are viscosity and freezing point depression. The viscosity is often rather low (like water), while the product has a strong freezing point depression.

Below a list of products that have been successfully concentrated before:

- White vinegar
- Wine vinegar
- Malt vinegar
- Cider vinegar
- Rice vinegar
- Balsamic vinegar

Whether you like to produce concentrates for the reduction of storage-, packaging- and/or transportation costs, a contrate to be used as an ingredient or maybe as a food preservative, our IceCon® technology is the right choice. It has the following advantages:

- Quality retention
- Simple, reliable and efficient operation
- Highly pure water discharge
- Small footprint
- Flexible in handling fluctuating feed concentrations
- Continuous operation
- No need for intermediate cleaning
- Low maintenance costs



Technical data

A white distilled vinegar for example can be concentrated up to 32 w/v% (320 grain) in a single stage unit set-up. Below business case is based on using our IceCon compact 60 unit for a 2-fold concentration of a white distilled vinegar.

Concentration of white distilled vinegar	
Feed concentration (w/w%)	150
Target concentration (w/w%)	300
Dewatering capacity (kg/hr)	700
Water purity (w/w%)	<0.2
Production rate (kg/hr)	700
Operator attention (min/hr)	5
Feed rate (kg/hr)	1,400
Annual production rate (kg/year)*	5,600,000
Electrical consumption (green) (kWh)**	65
Air (Nm³/h)	2
Warm water (m³/hr)	3.3
Footprint W x D x H (m)	7 × 8 × 8

* Based on 8,000 annual operating hours.
** Including refrigeration, based on COP of 2.7

The freeze concentration process works on a continuous basis. Due to the low temperature processing there is no need for intermediate cleaning. The system can run for days, weeks and even months at a row. Higher capacities and concentrations (up to 50 w/v%) are possible but require a tailor made design. On request the associated production costs can be calculated on a case-by-case basis.

How the process works

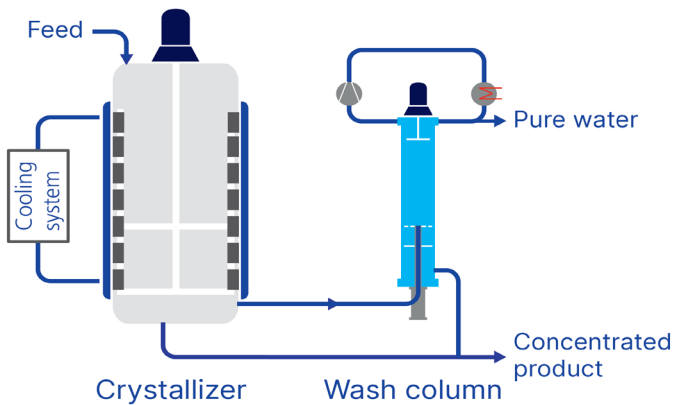
IceCon® is the latest innovation of freeze concentration design. The diagram below shows the complete process in its simplest form. This single-stage process consists of one crystallizer (1) and one wash column (2). The crystallizer is a vessel with a cooling jacket. The inner wall of the vessel is scraped. The outer wall is cooled by a circulating refrigerant. Ice production and ice crystal growth take place inside the crystallizer. By generating residence time, ice crystals grow, creating an optimal crystal size distribution for efficient separation. In the wash column, the concentrated liquid is separated efficiently from the ice crystals. A compressed ice crystal bed is washed with melted ice to remove all traces of concentrated liquid. Freeze concentration ensures that all original product characteristics are retained in the concentrate.

Contact

Please get in touch with our sales staff or browse our website where you can find our complete Freeze Concentration Technology catalogue as well as other brochures ready for download. Do not hesitate to contact us, we will be happy to help you. Our contact details can be found at the end of this techsheet.



Figure 1: How the process works



History of Freeze Concentration

Crystallization of water from liquid products has commonly been referred to as Freeze Concentration. The process has been applied in various forms for centuries. In its earliest form it was as simple as leaving a barrel filled with product outside in the winter and then draining the remaining liquid as concentrated product. The ice is formed as pure water crystals and everything else remains in the liquid. The early forms of freeze concentration generally had problems in efficiently removing the ice crystals as pure water. The concentrated product would stick to the ice surfaces resulting in undesirable product losses. In the more than 50 years our company exists it has enhanced the freeze concentration process with its unique solid-liquid separation into a sophisticated process that effectively eliminates these losses and fits perfectly into the modern processing plant.

Demonstration of this technology is possible in various configurations using GEA pilot plants. For more information regarding this technology and your specific configuration requirements, please contact us or get in touch with your local GEA contact on gea.com.

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