

Application

There is an increasing market for natural health products. These so called Nutraceuticals are a combination of nutritional supplements and pharmaceutical products derived from natural extracts. They generally contain a variety of components that provide some health benefit. These are usually complex specific compositions containing many volatile and heat sensitive components. Concentration techniques are used to reduce the shipping and storage volume, decrease the drying cost for the production of powders or produce new liquid products. The primary concern is to preserve the activity of the main components during storage or further processing into consumer products.

Product quality can be improved by reducing:

- ♣ Thermal deactivation.
- ♣ Specific component losses that may affect the composition balance.
- ♣ Chemical reactions (oxidation) that may affect the product stability.

The GEA Messo PT Freeze Concentration process is based on the crystallization of water from the solution. Crystallization is highly selective in the removal of water. The process also operates at freezing temperatures and therefore is capable of maintaining the original composition balance and protecting heat sensitive components. The GEA Messo PT process has been demonstrated in the commercial scale application in concentration plants for beer, wine, coffee, citrus, fruit juices, and vinegar. Many other products have been successfully concentrated on the pilot scale. The photo shows a pilot scale unit that produces market samples for various products.



Commercial configuration for the NFC-W6, a stand-alone freeze concentration unit complete with refrigeration and control system.

Process Engineering

GEA Messo PT

De Beverspijken 7b, 5221 EE 's-Hertogenbosch, The Netherlands
Tel +31 73 6390 390, Fax +31 73 6312 349
E-mail info.niropt.nl@geagroup.com, www.gea-messo-pt.com

Herbal Extracts

Freeze Concentration of Herbal Extracts and Nutraceuticals



Features:

High product quality as a result of:

- ♣ Low processing temperature. The concentration takes place at the freezing point of the product. All microbiological, bio-chemical and chemical reactions have virtually stopped. There is no thermal damage to the product.
- ♣ Efficient separation of the water. The separated ice crystals are 100% pure ice without any included product. The separation of ice crystals in the unique wash column separator is 100% efficient so that all the original components remain in the concentrated product. Volatile aroma components are retained within the liquid concentrate.
- ♣ No contact with air
- ♣ The process operates as a pressurized liquid filled system. Consequently, all contact with air/oxygen is eliminated and the potential for oxidation is minimized.

Continuous operation

- ♣ No need for intermediate cleaning
The process operates 24 hours per day without intermediate cleaning. System can be easily put on hold to handle temporary disruption in the feed supply.

Freeze Concentration answers the demand for:

- ♣ Concentration of aqueous solutions of complex heat sensitive components.
- ♣ High retention of active components
- ♣ New product development

Process Description

Water removal is the key to concentration of all aqueous products. Various methods are available to remove water from liquid food products. They can be divided into three main categories:

1. Evaporation converts water (and other components) into a vapour.
2. Membrane technology provides a barrier that allows water (and all smaller molecules) to pass.
3. Crystallization converts the water into solid ice crystals. Solid-liquid separators are required to remove the ice.

Evaporation is the most common and the most applied technique for concentration. The limited selectivity and high temperatures generally result in relatively poor retention of the original product quality.

Membranes can provide low operational costs but provide a relatively poor concentration factor and limited selectivity.

Crystallization is somewhat of an art and has a limited application base but provides the highest selectivity toward water removal and

the low operating temperatures maintain the activity of sensitive nutritional and flavour components. An efficient solid-liquid separation technology is required.

Freeze Concentration as a Crystallization Process

Crystallization of water from liquid products has commonly been referred to as Freeze Concentration. The process has been applied for centuries. In its earliest form it was as simple as leaving a barrel filled with product outside in the winter and draining the remaining liquid as concentrated product. The ice is formed as pure water crystals and everything else remains in the liquid. GEA Messo PT has enhanced the freeze concentration process with its unique solid-liquid separation into a more sophisticated process that fits quite well into the modern processing plant.

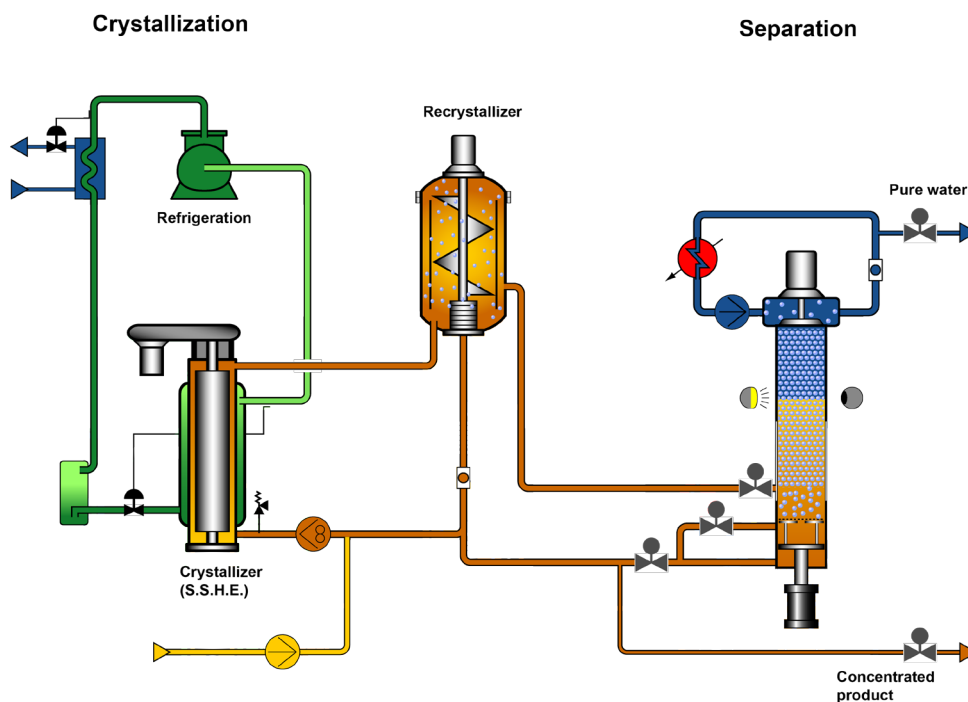
The schematic illustrates a basic single-stage freeze concentration process based on the GEA Messo PT developed and patented principles of separate nucleation and growth. This technique creates the optimum growth conditions for an efficient separation and provides the highest concentration factor for most food liquids.

Commercial systems are designed from standard component sizes depending on your throughput requirements. Multistage systems were developed along with larger components to allow for any capacity up to > 30,000 kg/h.

Freeze Concentration – precision water removal at freezing temperatures ensuring product quality at its technical best.

Next Steps...

For more information regarding this technology and your specific configuration requirements please contact us at: info.niropt.nl@geagroup.com or phone +31.736 390 390.



The feed product enters the scraped surface heat exchanger (crystallizer) where the refrigerant cools the product and produces very small ice crystals (nuclei).

These small crystals flow into the recrystallizer where they are allowed time to grow into large spherical ice crystals.

Since these crystals are pure water the final step is removal in the GEA Messo PT wash column.

The separation provided by this unique device is so complete that the losses are barely measurable.