

## Application

The beverage industry's demand for high quality products at acceptable prices generally drives the development of new process technologies. Maintaining the natural look and fresh taste creates a conflict with factors like shelf life, transportation and storage cost.

Water is the focus of this problem. A variety of concentration techniques have been developed for the efficient removal of this single component. The aim of concentration is to add value to the product.

Factors that affect the added value are:

- ♣ Concentration factor indicates how much water is removed.
- ♣ Microbiological and chemical factors affect the product stability and reduce shelf-life and are both a function of the remaining water.
- ♣ Bulk handling properties at low temperatures are improved with reduced water content.

Water removal costs are influenced by capital, operational, equipment cleaning and maintenance costs, product losses and even charges for disposing the water you just removed.

The GEA Messo PT Freeze Concentration technology provides the highest quality retention with a relatively high concentration factor against reasonable cost.

GEA Messo PT freeze concentration is commercially applied in the citrus industry for concentrating orange-, grapefruit- and mandarin-juices and other fruit juices like strawberry juice, grape juice, lemon juice, black/red current juice, raspberry juice, blue/black berry juice, grape juice, peach juice, banana juice, cranberry juice, and others.

The wash column (ice separator) of a commercial Freeze Concentration plant for orange juice illustrating the sharp separation between washed ice (top) and ice with concentrate (bottom)



# Citrus and other Fruit Juices

## Freeze Concentration of Citrus and other Fruit Juices



### Features:

#### High product quality as a result of:

- ♣ Low processing temperature. The concentration takes place at the freezing point of the product (e.g.  $-8^{\circ}\text{C}$ ). 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.
- ♣ 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.

Process Engineering

### GEA Messo PT

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## Continuous operation

- ♣ No need for intermediate cleaning  
The process operates 24 hours per day without intermediate cleaning. Throughput is flexible between 0 and 100% of design capacity.

## Fresh from Concentrate

- ♣ Alternative to not-from-concentrate  
Single strength juices have gained market share due to its quality and image. Cost levels are limiting this growth. Freeze concentration can produce reconstituted juices at the same quality and at lower cost and thus can contribute to expansion of top quality juices in the market.

## Freeze Concentration answers the demand for:

- ♣ High quality, healthier chilled juices
- ♣ Enhanced market position in increasingly competitive markets
- ♣ New product development

## Process Description

Water removal is the key to concentration of all food 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 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 food processing plant.

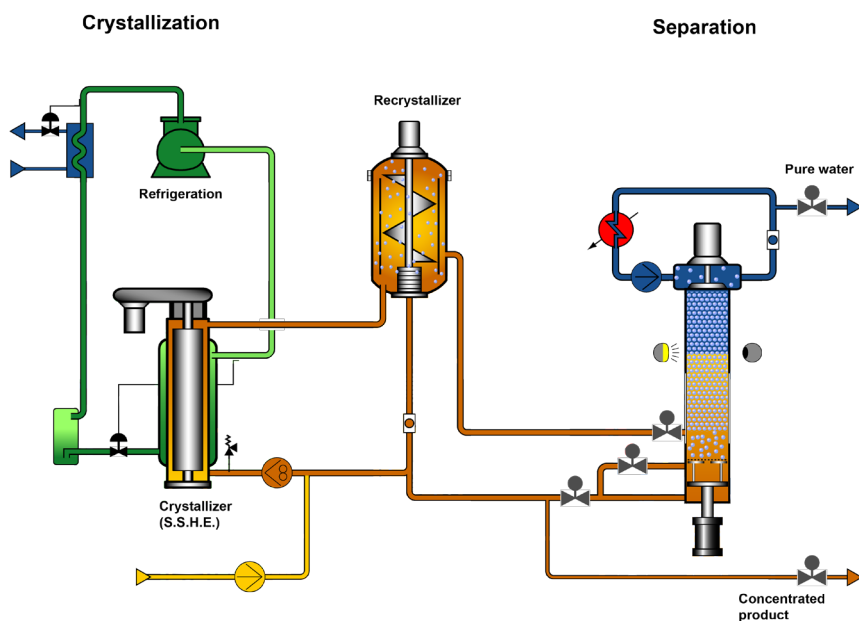
The schematic illustrates a basic single-stage freeze concentration process based on the GEA Messo PT developed and patented principles of separate nucleation and growth. This technique creates the optimum growth conditions for an efficient separation and provides the highest concentration factor for 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](mailto: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 efficient that no losses occur.