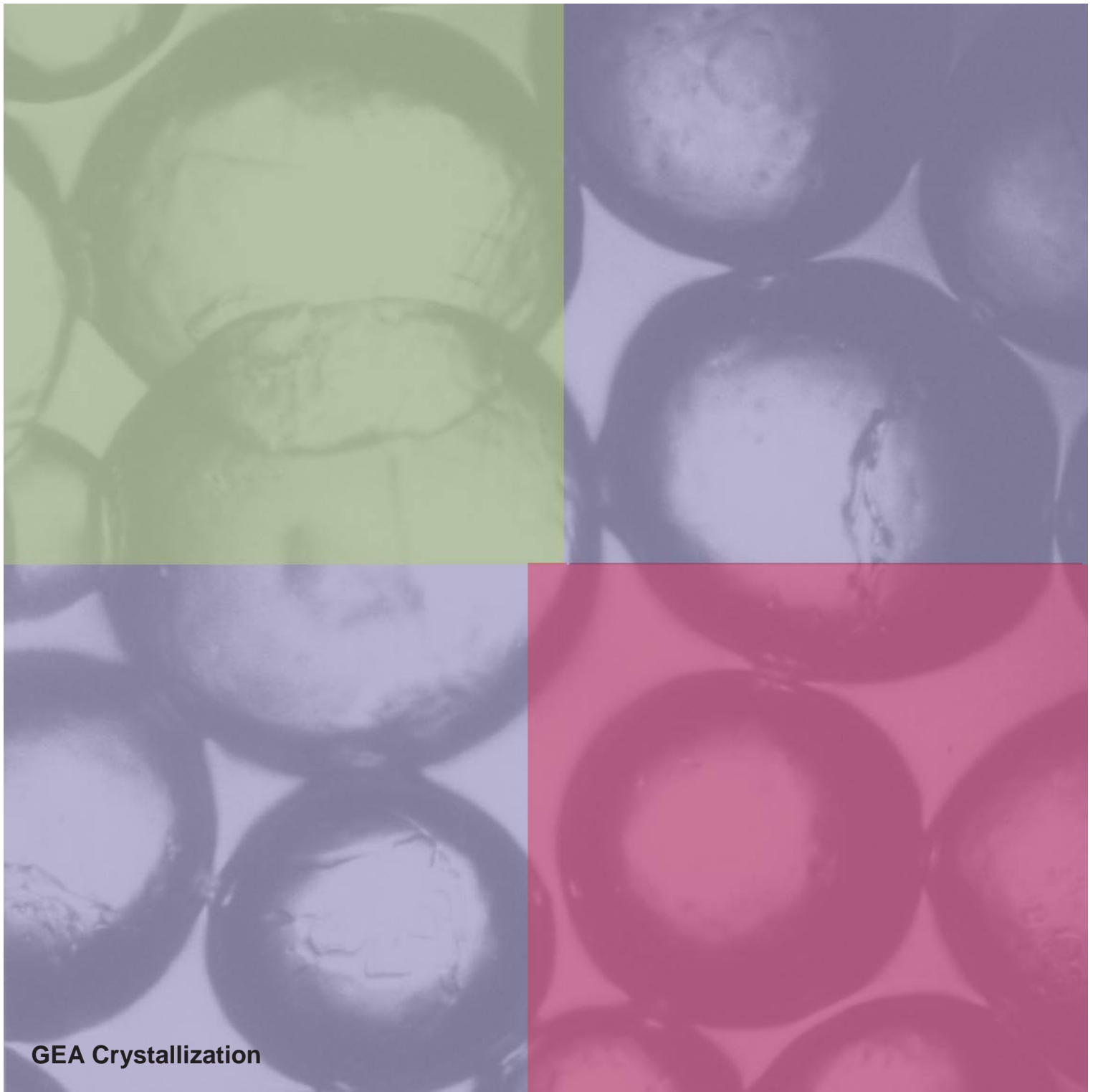


Crystallization & Separation

Break barriers in liquid processing



GEA CrystallizationOne Sales Portal,Two Operational Entities, Three Brands:

Together with the Kestner Division in GEA Process Engineering France as our partner, we have formed GEA Crystallization as our joint sales and marketing alliance and brand for all crystallization and related concentration technologies within the GEA group.

GEA Crystallization is selling Kestner, Messo and Niro PT technologies to the worldwide markets and represents a cornerstone in our efforts to provide our customers a better sales service with a clarified market approach.

GEA Crystallization			
Company	Kestner Division of GPFR	GEA Messo PT	
Office Location	Paris	Duisburg	's-Hertogenbosch
Technology brand	Kestner	Messo	Niro PT

Structure of GEA Crystallization

GEA Messo PT

GEA Messo PT is well established as globally recognized technology supplier and plant constructor in the field of solution – and melt crystallization and related concentration technologies with focus on business activities to a selected range of industrial applications.

GEA Messo PT has been established as a merge of the German based GEA Messo GmbH and the Netherlands based GEA Niro PT B.V. into one operational entity. The newly formed company combines the two technology centers for solution crystallization (Messo) and melt crystallization/freeze concentration (Niro PT) allowing to use all cross-fertilizing synergies between solution and melt crystallization. At the same time, our customers profit from a better support out of larger and consolidated departments in sales, project management, services and administration. Today, GEA Messo PT is selling Messo technology and Niro PT technology as one company from our two technology centers in Duisburg and 's-Hertogenbosch.



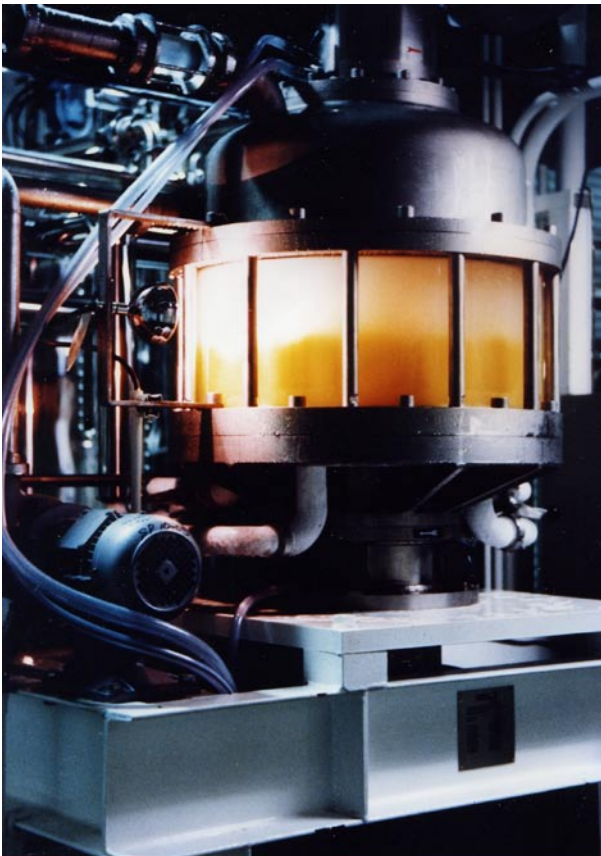
GEA Messo PT, 's-Hertogenbosch office

GEA Messo PT forms part of the GEA Process Engineering (P-Division) of the GEA Group.

Introducing Crystallization and Separation

Many industries need to dewater aqueous solutions. The objectives of the process, though, may vary widely. They range from achieving concentrates (food liquids) to creating ultra-pure substances (chemical and pharmaceutical industries or residues that can be safely disposed or re-used (treatment of hazardous waste water).

Crystallization and separation comes into the picture where the water of aqueous solutions or components of organic substances can be transformed into spherical, and consequently easily separable crystals. The result is unprecedented product quality or purity of substance. This process is generally referred to as freeze concentration when applied to aqueous solutions.



Wash Column Separation in orange juice application

When supreme quality liquid food concentrates are requested freeze concentration is the process of your choice. Niro PT invented, commercialized and further developed this leading edge technology over the last decades. No other concentration processes can obtain the outstanding product qualities which are achievable with the Niro PT technology.

The very gentle concentration at sub-zero temperatures allows product freshness to be maintained and prevents biological degradation to occur. Since no vapour phase is present all volatile aromas will be preserved in the food concentrates.

Over 50 freeze concentration plants have been put into operation throughout the world with more than 100 Niro PT Purifiers in commercial service. Various configurations with capacities ranging from 100 to 400,000 tons per year have been installed..

Your business and Crystallization and Separation

The crystallization and separation process can be used to achieve:

- ♣♣ quality concentrates;
- ♣♣ ultra-pure chemical or pharmaceutical substances;
- ♣♣ recyclable waste streams, while reducing the volume of hazardous waste streams for disposal.

Further, the process can be used to change product properties and to develop new products.



Freeze Concentration Installation for coffee extract

Liquid foods

Concentration has been common procedure among liquid food processors for many years. Rather than moving tons of water around the world, they reduce volume to economize on packaging, storage and transportation. Conventional concentration methods, however, often compromise quality.

Here, the NIRO process makes the difference, as it has proved to be superior in retaining the liquid's original properties.

Chemical processes

In the chemical industry, the purity of the substances produced is the key issue. When the wash column is introduced in the process, higher yield and higher quality can go together. The result is a better return on investment. The purity achieved through wash column separation is hard to match by other separation techniques.



Pharmaceutical processes

The pharmaceutical industry has discovered that the applied freezing point technology is ideal for treating heat-sensitive substances, which would experience a loss of activity if processed through different methods. As in the chemical industry, the reward of the NIRO process consists of the more efficient use of raw materials and compounds, better quality and, in the end, better returns.

Hazardous waste water

A new feature involves the proven suitability of the NIRO process for treating hazardous waste water and other effluents. The NIRO system divides the waste stream in two streams: a pure water stream that is either disposed or brought back into the process and a concentrated waste stream for further processing, such as incineration. Handling and incineration costs are significantly reduced.



Wash Column Unit

Process objective	Concentration	Separation	Purification	Improvement	New products
<i>Liquid foods:</i>					
Coffee	•			•	•
Tea	•			•	•
Citrus juices	•			•	•
Fruit juices	•			•	•
Vinegar	•	•			•
Wine	•		•		•
Beer	•			•	•
Dairy				•	•
<i>Chemicals:</i>					
	•	•	•	•	
<i>Pharmaceutical products</i>					
	•	•	•	•	
<i>Hazardous waste water:</i>					
	•	•			



Process Engineering / GEA Crystallization

Koertner Division

GEA Messer DT

Economics

Crystallization and separation presumably entails higher initial costs than other concentration systems such as evaporation. On the other hand, freeze concentration yields premium results. Additional advantages include low energy costs and a continuous process that enables longer operating periods without intermediate cleaning. Overall, total cost is indeed competitive with conventional systems, with unmatched quality as an extra reward. Our specialists will be happy to provide detailed insight about the feasibility of the process for your product.



Wash Column Unit



Scraped Surface Heat Exchangers



Capacities

The capacity range is very broad. Today, crystallization and separation units have water removal capacities ranging from 100 kg per hour to 25,000 kg per hour. Thus, the crystallization and separation process is suitable not only for a variety of products, but also for small-volume specialty runs and large-scale operations.

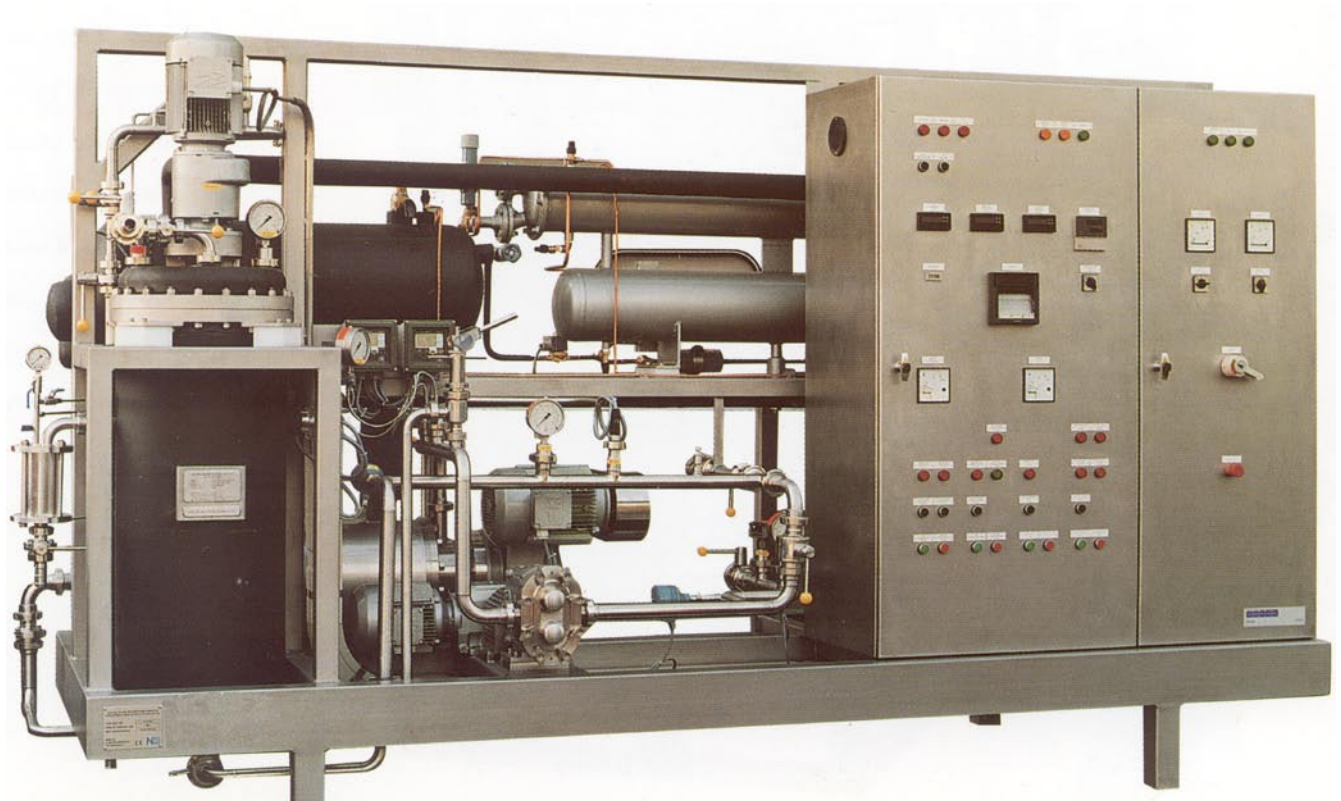
Trial service

Seeing is believing. Where calculations may suffice for proven applications, it is only normal that for new concepts and products the technical feasibility is assessed prior to the investment.

GEA Messo PT rents out pilot plants for in-house trials. The prospective customer could also supply feed for pilot runs on the premises of GEA Messo PT.



Pilot Plant Unit



Picture will be replaced by photo of new 1NFC6#5 (picture still to be made)



Proven Applications

Liquid foods

Soluble coffee

Key aspects

- ◆◆quality concentration
- ◆◆aroma retention
- ◆◆new varieties
- ◆◆quality boost of freeze or spray drying
- ◆◆cost reduction



Citrus juices

Key aspects

- ◆◆natural freshness
- ◆◆quality concentration
- ◆◆premium pricing
- ◆◆cost reduction

Other fruit juices

Key aspects

- ◆◆product development
- ◆◆high quality ingredients
- ◆◆in many cases the only viable concentration technique
- ◆◆cost reduction

Beer

Key aspects

- ◆◆only proven concentration technique
- ◆◆economic storage and distribution
- ◆◆peak shaving
- ◆◆reducing aging time
- ◆◆new products,
 - ◇ low or non-alcohol
 - ◇ ice beer
- ◆◆stability

Other

Dairy products (improved final products, better semi-finished products for processors), tea, vegetable juices and other plant extracts.

Vinegar

Key aspects

- ◆◆ingredient of high concentration
- ◆◆cost reduction

Wine

Key aspects

- ◆◆control of alcohol level
- ◆◆cost reduction
- ◆◆high quality intermediate



Waste Water Concentration Plant



Chemical industry

Organic melt crystallization processes

Key aspects

- ◆◆ultra-pure product (99.9+)
- ◆◆debottle-necking
- ◆◆crystal stability
- ◆◆lower inert material circulation

The NIRO process is successfully applied in the production of paraxylene.

Pharmaceutical Industry

Key aspects

- ◆◆mild process conditions
- ◆◆heat sensitivity
- ◆◆aseptic operation
- ◆◆no thermal damage to active components

Hazardous Waste Water

Key aspects

- ◆◆less impact on environment
- ◆◆high purity discharge water
- ◆◆reduced incineration load
- ◆◆less water consumption (re-use)



Wash Column Purifier for organic liquids
(picture to be re-scanned)

How the Process Works

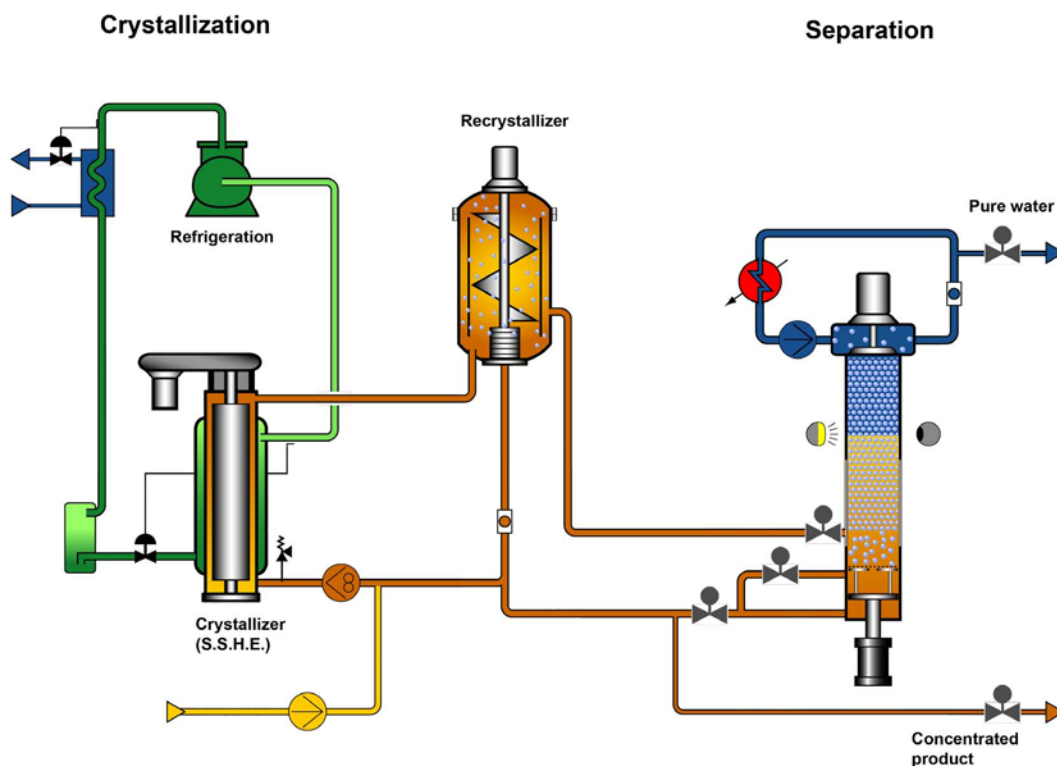
Most (food) liquids consist of water and dissolved solids. In most cases the water content is 90% or more. Part of this water can be removed by the freeze concentration system, which consists of a crystallization section and a separation section. In the crystallization section part of the water present in the product is converted into spherical ice crystals. In the separation section these ice crystals are separated from the concentrated liquid by means of a wash column.



In its simplest form, the process works as follows: the unconcentrated liquid is pumped from the feed tank (1) into a scraped surface heat exchanger (3), where small ice crystals are formed instantly. These very small crystals are then pumped (2) to the recrystallizer (4). Here the small crystals, which have been formed in the heat exchanger, are mixed with the larger crystals. Smaller crystals have a slightly lower equilibrium temperature than larger ones. When large and small crystals are mixed, the smaller crystals will melt and recrystallize on the surface of the larger crystals, which will grow.

The slurry (concentrate and crystals) is transported from the recrystallizer to the wash column (5). In the wash column, the concentrate is “squeezed” through a filter at the bottom. In this way a packed bed of ice crystals is formed. The packed bed is “pushed” upwards. At the top of the wash column the ice is scraped off (6) and melted (7). Part of the melted ice is used to “wash” the packed bed. The concentrate, which is still present in between the ice crystals, will be displaced by water.

A sharp separation will be formed between the washed part of the bed (crystals and water) and the not-washed part of the bed (crystals and concentrate). This is called the wash front. The water is removed at the top of the wash column. In this separation process, the loss of soluble solids in the removed water is generally in the ppm or even ppb range. The final concentrate will be pumped to the storage vessel or to the next stage in the production process. The diagram shows the complete process in its simplest form (single stage). Multi-stage operation can bring about a significant reduction in production costs.



Inherent Advantages of the Niro Process



- ♣♣♣ The NIRO process can remove pure water from most multi component aqueous solutions without any loss of volatile compounds or soluble solids;
- ♣♣♣ Operating at freezing point temperature, the process prevents quality degradation, because of the low microbiological, chemical and biochemical activity;
- ♣♣♣ The use of wash columns for separating the ice crystals eliminates soluble losses in or around the crystals;
- ♣♣♣ As the system is pressurized, ambient air cannot enter, which prevents oxidation;
- ♣♣♣ Continuous operation: the hygienic design, in combination with low temperature, eliminates the need for intermediate cleaning;
- ♣♣♣ The totally closed system prevents losses of volatile aromas and other valuable components;
- ♣♣♣ Stable operation, simple control, insensitive to variations in feed composition.



Wash Column Ice Separator



Contact us at:

www.gea-crystallization.com



Process objective	Concentration	Separation	Purification	Improvement	New products
<i>Liquid foods:</i>					
Coffee	•			•	•
Tea	•			•	•
Citrus juices	•			•	•
Fruit juices	•			•	•
Vinegar	•	•			•
Wine	•		•		•