

Suspension Crystallization

The suspension-based crystallization process operates with an extremely large number of crystals providing a massive growth surface. Since the total surface absorbs the under-cooling of the solution, the resulting overall growth rate is very slow. This near ideal growth rate allows the formation of pure crystals in a single step.

Solid-Liquid Separation

Complete separation of the pure crystal from the impure mother liquor is required. This is accomplished within the unique GEA Messo PT Purifier - our proprietary wash column technology.

Highly Efficient Separation Process

The massive surface needed to create near ideal growth conditions requires an efficient washing process to remove the impure liquid from the crystal surface.

High purity is possible with the GEA Messo PT Purifier because:

- ◆ the crystal is already pure
- ◆ the counter-current wash uses pure melt
- ◆ the crystal bed is more than 50 cm height.

The unwashed crystal mass is roughly 70-80% crystalline product with the remainder being the impure liquid mother liquor. As the pure wash liquid (product melt) is forced through the porous crystal bed it will effectively wash away any impurities in the unwashed part of the bed and recrystallize as new crystal product upon contacting the relatively cold crystals.

This configuration provides highly efficient contact between crystal and wash liquid and allows sufficient time to recrystallize the wash liquid within the packed bed thereby essentially eliminating product losses.

The heat released by this crystallization warms the surrounding crystal mass. This is a self controlling process where the recrystallizing wash liquid will release enough heat so that the crystals will reach the equilibrium temperature of the pure product.

This recrystallization zone, generally called the wash front, is a relatively narrow portion of the column. This wash front marks steep gradients in temperature, concentration and porosity.

Suspension Crystallization

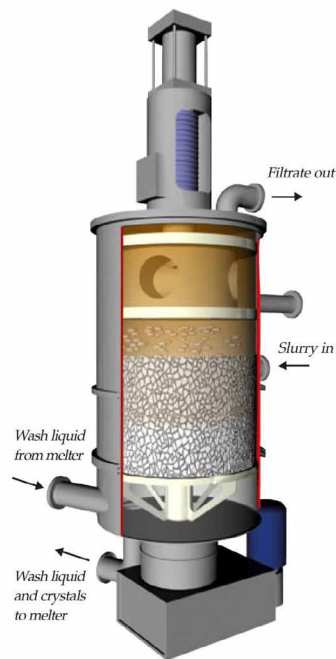
Highly Efficient Solid-Liquid Separation



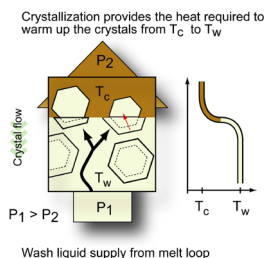
Process Engineering

GEA Messo PT

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A reciprocating piston/filter draws a charge of crystal slurry into the GEA Messo PT Purifier and compresses this charge into a compact bed of crystals while allowing the mother liquor to leave through the filter. The scraper starts and the piston/filter continues to force the existing crystal bed through the column as the scraper disintegrates the bed at the opposite end of the column.



The pure melted product is forced counter-current to the crystal bed flow. The porous bed provides a unique environment where the pure melt contacts the significantly colder crystals

and results in complete recrystallization of the wash liquid. This counter-current wash flow effectively removes the impurities remaining around the crystals and returns the wash liquid as pure product crystals. The washed crystal bed is disintegrated by a rotating scraper. The crystals are then reslurried with circulating pure melt and melted in a heat exchanger. The final product is removed through a control valve. Restricting this discharge will result in an increase in the pressure of the circulation loop which drives the washing action in the crystal bed.

No wash liquid is lost to the filtrate

After completing its task as wash liquid, the new crystal product is transported together with the now warmer crystals back towards the pure wash circuit.

This unique environment, not found with shorter crystal beds, allows a rather simple control strategy for maintaining product purity and eliminating loss of wash liquid.

The position of the wash front can be measured and used to control the washing pressure that determines the position of this wash front; higher pressure forces the wash front further away from the pure melt circuit.

Maintaining the product purity is easy:

Since the wash front does not need to be precisely located, small changes in the operating parameters, which move the wash front, have little effect on the performance of the GEA Messo PT Purifier.

A traditional suspension-based crystallization process uses filters or centrifuges for the separation of crystals from the mother liquor. They utilize cross-flow washing of relatively thin crystal cakes (filter-cake thickness of about 1 to 5 cm) to increase the final product purity. These methods require 10 - 20% of the final product as wash liquid to achieve even moderate product purities. The excess wash liquid quickly passes through the cake and produces an extra stream of contaminated product.

The crystallization section has to be sufficiently sized to treat this extra quantity of product and represents wasted resources for this inherent inefficiency.

Technology highlights:

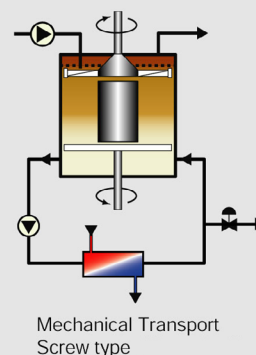
- ◆ Ultra high purities
- ◆ Low energy consumption
- ◆ Low capital cost
- ◆ Ease of operation
- ◆ Small footprint
- ◆ High recovery
- ◆ Slurry handling



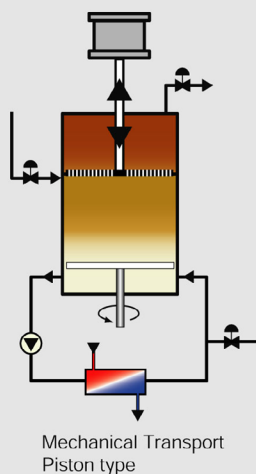
Next Steps..

On-site demonstration of this technology is possible using one of GEA Messo PT's pilot plants. For more information regarding this technology and your specific configuration, please contact: info.niropt.nl@geagroup.com or phone +31.736 390 390.

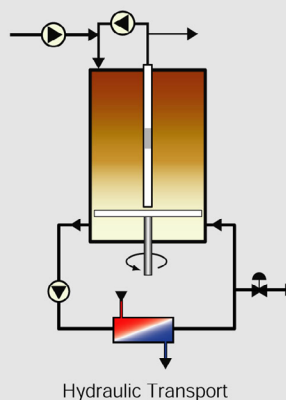
Wash column technologies



The screw-type, described above, is generally used for larger throughput requirements.



The piston-type uses a reciprocating filter piston that forces crystals through the column and is generally used on smaller capacities for more difficult separation conditions (e.g. smaller crystal size, high liquid viscosity, high temperature differences).



The hydraulic-type uses another proprietary filter system that allows hydraulic transport eliminating both rotating transport screw and reciprocating piston.