Suspension Crystallization

Highly Efficient Product Crystal Separation

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.

Product Crystal 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 Product Crystal Separation

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:

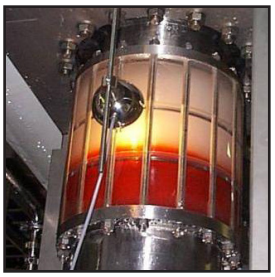
- the crystal is already pure and
- the counter-current wash uses pure melt
- the crystal bed is more than 50 cm height.

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 Wash Column Process

Crystal slurry enters the wash column at equilibrium with the mother liquor composition from the crystallizer and the crystals are therefore significantly colder than the melting temperature of the pure product. Most of the liquid mother liquor is discharged through a filter and can now be removed as reject or passed to a recovery stage.

This compression step results in a porous packed bed of approximately 70-80% solids with the remainder being the impure mother liquor. Pure wash liquid is forced through the porous crystal bed and effectively washes away any remaining impurities.



Process Engineering / GEA Crystallization

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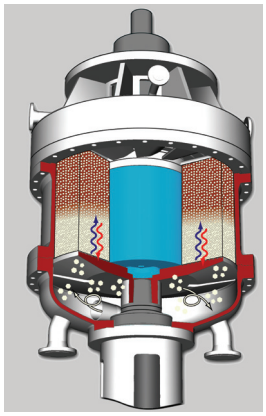
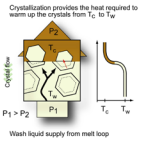


The crystal slurry is pumped into the GEA Messo PT purifier and distributed over a sturdy wedge-wire filter plate. A slowly rotating screw transporter compresses the crystal slurry while allowing the mother liquor to leave through the stationary filter. The transporter (see photo) continuously sweeps the filter and forces the crystal bed toward the opposite end of the column.



The pure 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 mass 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.

No wash liquid is lost to the filtrate

After When the wash liquid contacts a cold unwashed crystal it immediately recrystallizes on the existing surface. This forces impurities away from the crystal and generates heat to warm up the crystal. 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 where they are melted and provide a continuous source of wash liquid.

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 temperature change over the washfront can be measured and used to control the washing pressure that determines the position of this washfront; higher pressure forces the washfront 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.

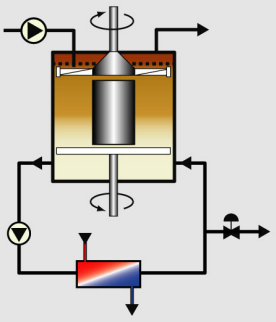
A traditional suspension-based crystallization process uses filters or centrifuges for the separation of crystals from the mother liquor. They utilize cross-flow washing of relatively thin crystal cakes (filter-cake thickness of about 1 to 5 cm) to increase the final product purity. These methods require 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 wash liquid. The crystallization section has to be sufficiently sized to treat this extra quantity of product and represents wasted resources for this inherent inefficiency.

The sharp separation between the washed and unwashed portion of the crystal bed (wash front) is illustrated on a W60 screw-type wash column.

Technology highlights

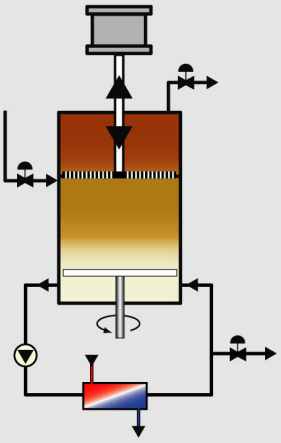
- Ultra high purities
- Low energy consumption
- Low capital cost
- Ease of operation
- Small footpring
- High recovery
- Slurry handling

Wash column technologies



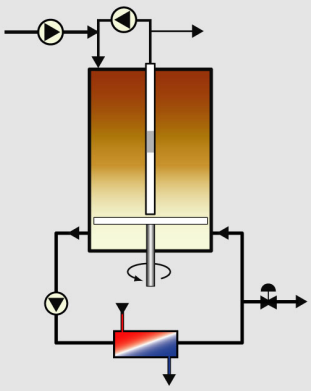
Mechanical Transport
Screw type

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



Mechanical Transport
Piston type

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).



Hydraulic Transport

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

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.