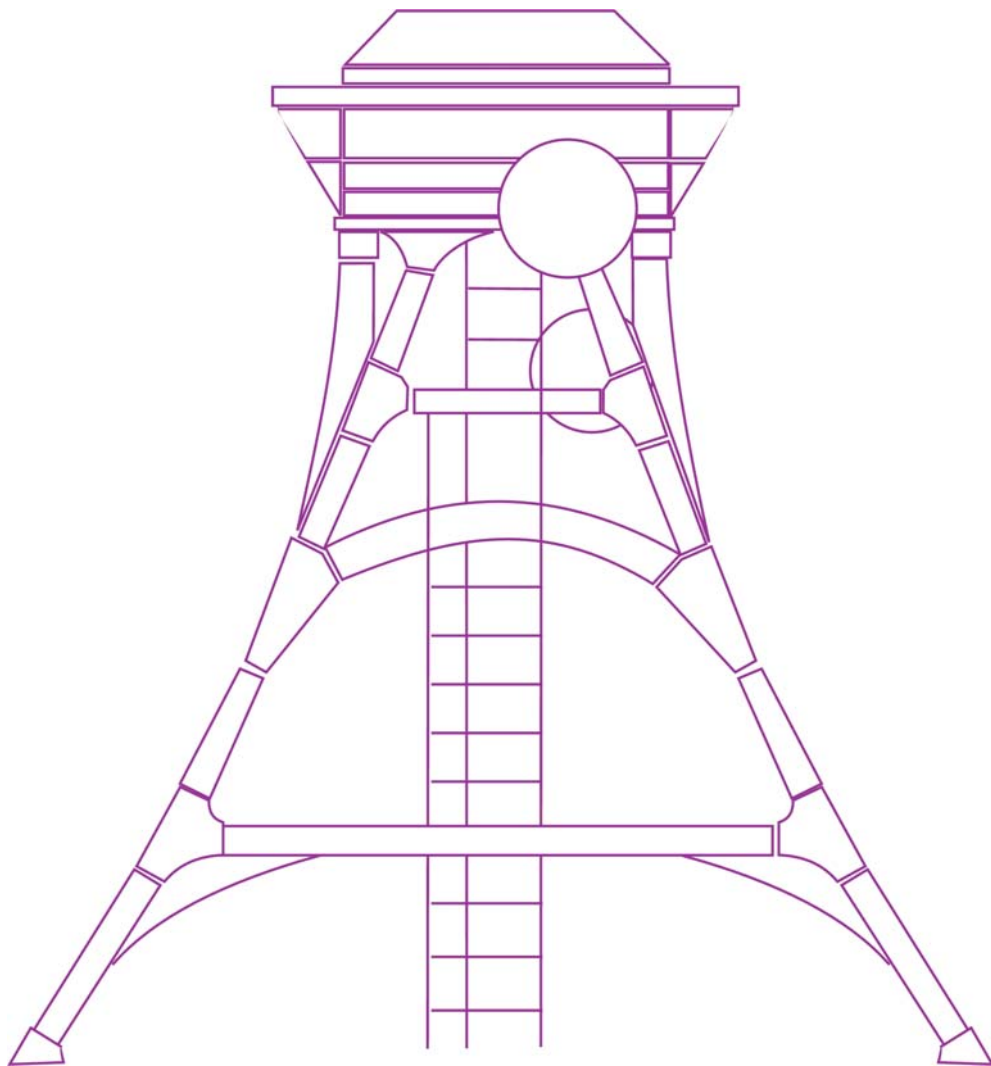


K-UTE ***SONDERSHAUSEN***



Precipitation Crystallisation of Poorly Soluble Materials

Precipitation of Poorly Soluble Materials

Kali — Umwelttechnik GmbH (K-UTECH)

Am Petersenschacht 7
99706 Sondershausen
Germany

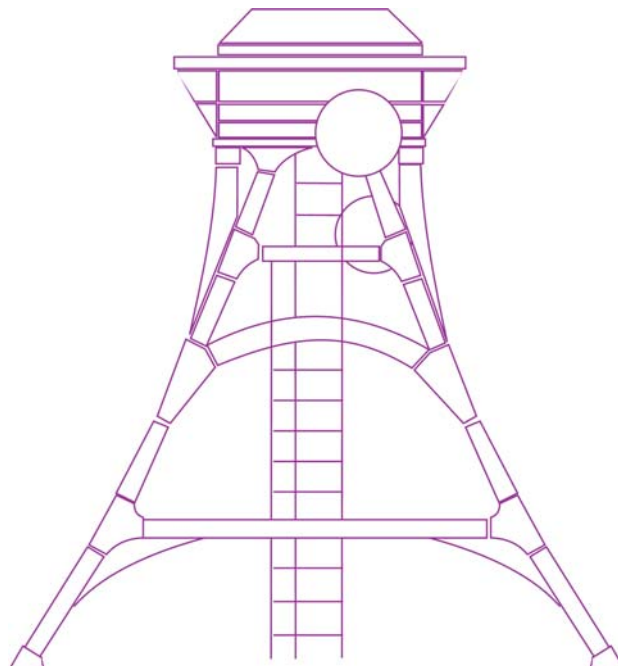
Phone: ++ 49 – 3632 – 610-0
Fax: ++ 49 – 3632 – 610-105
e-Mail: kutec@kutec.de

General Manager: Dr. Heiner Marx
Dr. Holger Thoma

Department: Chemical & physical Engineering

Head of Department: Grad. Physicist Jürgen Bach

Phone: ++ 49 – 3632 – 610-120
Fax: ++ 49 – 3632 – 610-105
e-Mail: Juergen.Bach@kutec.de



Precipitation of Poorly Soluble Materials



<u>Conventional Technology</u>	<u>K-UTEC-Technology</u>
<i>Discontinuous Precipitation</i>	<i>Discontinuous Precipitation</i>
Precipitation in agitator kettles in batch-wise operation	-
Presentation of one reactant and adding of the second	-
Very high super-saturation and very fine grained precipitation products	-
<i>Continuous Precipitation</i>	<i>Continuous Precipitation</i>
<ul style="list-style-type: none"> • Precipitation in agitator kettles with regular solid content of reaction suspension • Feed of both reactants to the mixed suspension and following thickening of reaction suspension • Small amount of aggregated particles, wide range of grain size distribution 	<ul style="list-style-type: none"> • Precipitation in stirred crystallisers at increased solid content of reaction suspension and extended residence time for the precipitated crystals in the reactor • Controlled precipitation, • Feed of both reactants and circulation of reaction suspension • Extraction of material from the reactor with integrated clarification area • Strong agglomerated, often spherical particles with narrow range of grain size distribution,

Advantages of the K-UTECH Technology

➤ Improvement of Product Quality

- Increasing of the average grain size is possible.
- Production of a narrow range of grain size distribution.
- Materials with defined grain size distribution can be produced, for magnesium hydroxide for example from d_{50} 10 μm up to d_{50} 150 μm .
- Also difficult material like hydroxides can be produced with high settling velocity and good filtration and washing behaviour.
- Improved particle properties lead to a higher purity of the products.
- Production of precipitation products with “tailored” properties (particle size, particle size distribution, bulk density and tamped density, specific surface area etc.

➤ Improvement of Process Management

- Continuously running operation for all process steps.
- Flexible operation. No emptying of apparatuses is required during interruption of material dosing.
- Exactly controllable process.
- Long operation periods without stop, because of low incrustations.
- High process steadiness, because of long residence times of precipitation products in the apparatuses.
- Manufacturing of products with higher settling velocities and filtration velocities compared to conventional technologies.
- Replacement of filter presses by belt filters or screen centrifuges is possible.

Description of the K-UTEK Crystalliser

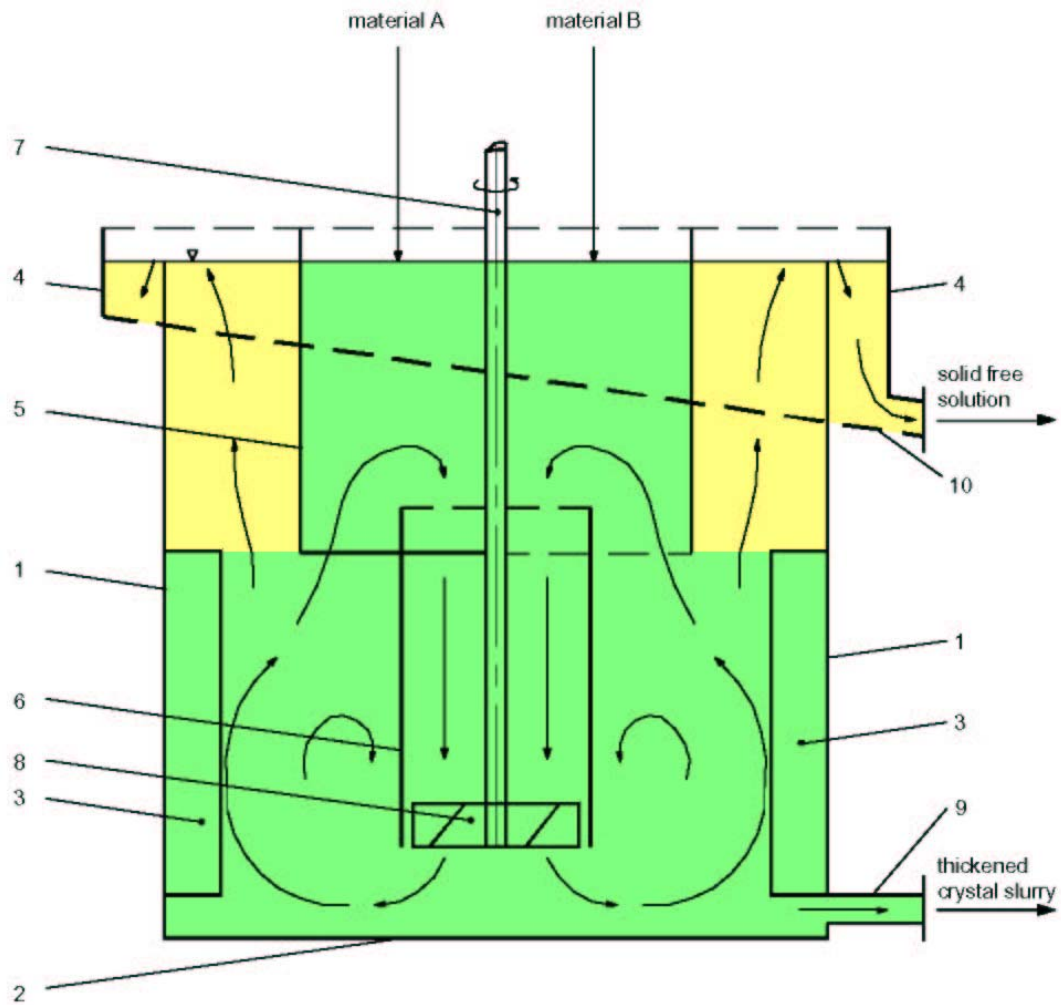
The **K-UTEK**-Crystalliser is the main part of the **K-UTEK**-Crystallisation process. The agitated crystalliser is a special type of loop reactor with an inner crystallisation and reaction zone and an outer integrated clarification area. Special features are the downward acting axial stirrer (8) (pitched blade stirrer) and the simple shape of the vessel (1) with a flat bottom (2). This flat bottom enables the direct erection on a concrete foundation.

Entering solution and precipitation reagent reach the intensively mixed central part of the stirred vessel (1). Mixing takes place by means of the axial stirrer (8) with stirrer shaft, pitched blade stirrer and driver (7). The downward directed flow, induced by the stirrer, and the internal streaming fittings maintain a loop flow of the suspension inside the reactor. The inside streaming fittings are wall baffles (3), annular separation sheet (5) and other additional flow baffling installations. Around the stirrer shaft a draught tube (6) is installed. Crystal growth takes place in the intensively mixed central part, clarification of liquid takes place in the outer clarification zone that is integrated in the apparatus. The pre clarified solution leaves the reactor via an overflow launder (4). The thickened precipitation product is withdrawn from the apparatus via the discharge socket (9).

For heat transfer the apparatus is fitted with a double-walled jacket.

The **K-UTEK** stirred crystalliser can be operated by atmospheric pressure or in vacuum.

In laboratory and bench scale size the **K-UTEK** crystallisers are available with capacities of 20 l, 100 l, 400 l and 1000 l. Apparatuses in technical scale were built with capacities of 10 up to 350 m³.



- 1 cylindrical vessel
- 2 flat or conical bottom
- 3 wall baffles
- 4 overflow launder
- 5 circular separation sheet
- 6 draft tube
- 7 vertical stirrer shaft
- 8 pitched blade stirrer
- 9 crystal discharge
- 10 solution discharge

TYPICAL CONSTRUCTION OF CRYSTALLISER

Material Examples

Controlled precipitation crystallisation according to the **K-UTEC**-process is applicable in principle for all poorly soluble materials as there are:

- Hydroxides
- Sulphides
- Carbonates
- chloride containing double salts
- Sulphates
- sulphate containing double salts
- Aluminates
- threefold salts

special applications:

- Magnesium hydroxide (Mg(OH)₂), spherical particle shape
- Magnesium hydroxide (Mg(OH)₂), foliated particle shape
- Nickel hydroxide (Ni(OH)₂), spherical particle shape
- Calcium carbonate (CaCO₃), spherical particle shape
- Na-rare earth sulphate (Na₂SO₄·La₂(SO₄)₃·nH₂O)
- Ca-Aluminates (2CaOHCl·2Ca(OH)₂·5Al(OH)₃)
- Ca-Sulphate (CaSO₄·2H₂O)
- K-Ca-Sulphate (K₂SO₄·CaSO₄·H₂O)
- Ammonium-Nickel sulphate ((NH₄)₂SO₄·NiSO₄·6H₂O)
- Heavy metal sulphides (MeS)
- Barium-Sulphate (BaSO₄)
- Carnallite (KCl·MgCl₂·6H₂O)

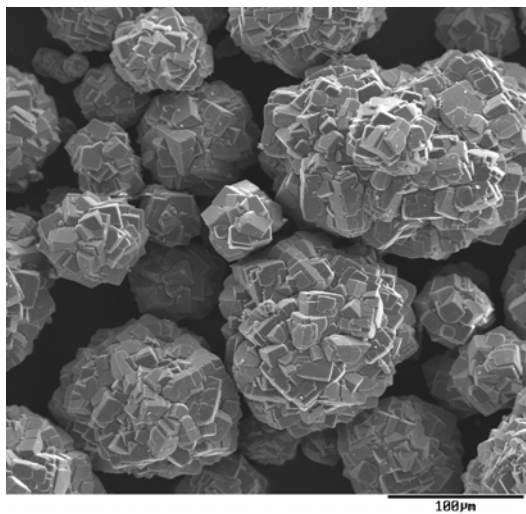
Typical Particle shape



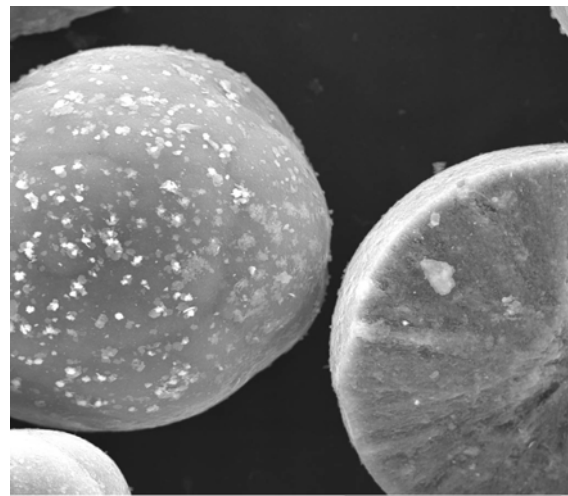
Mg(OH)₂



Ni(OH)₂



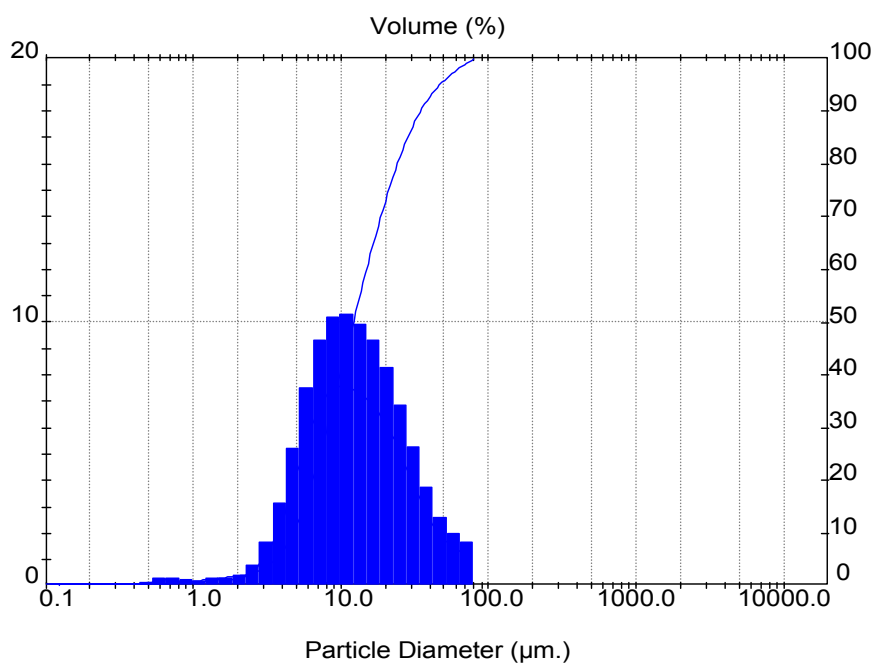
Calcit



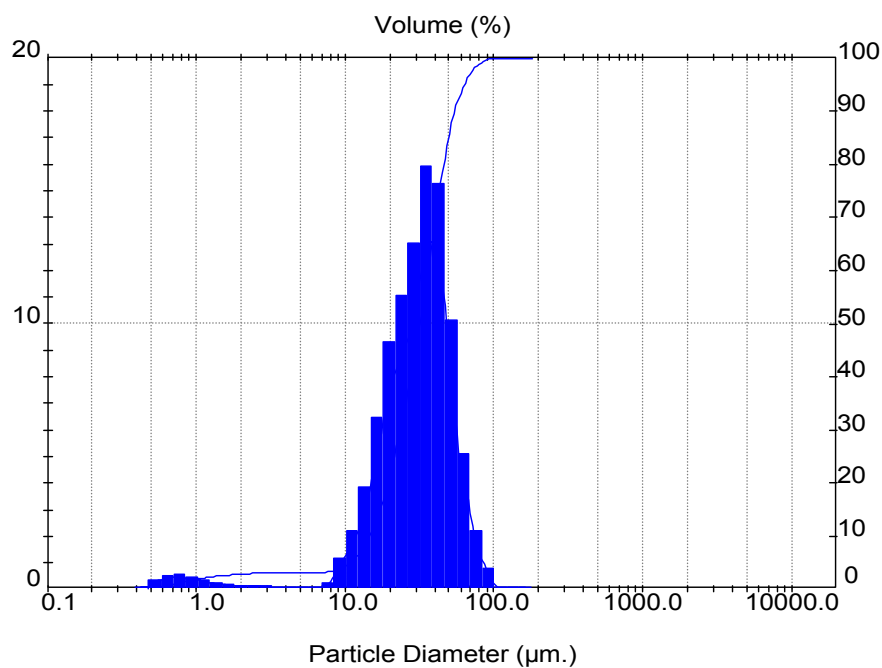
Mg(OH)₂

Typical Particle Size Distributions

Ni(OH)₂



Mg(OH)₂



Our Performances

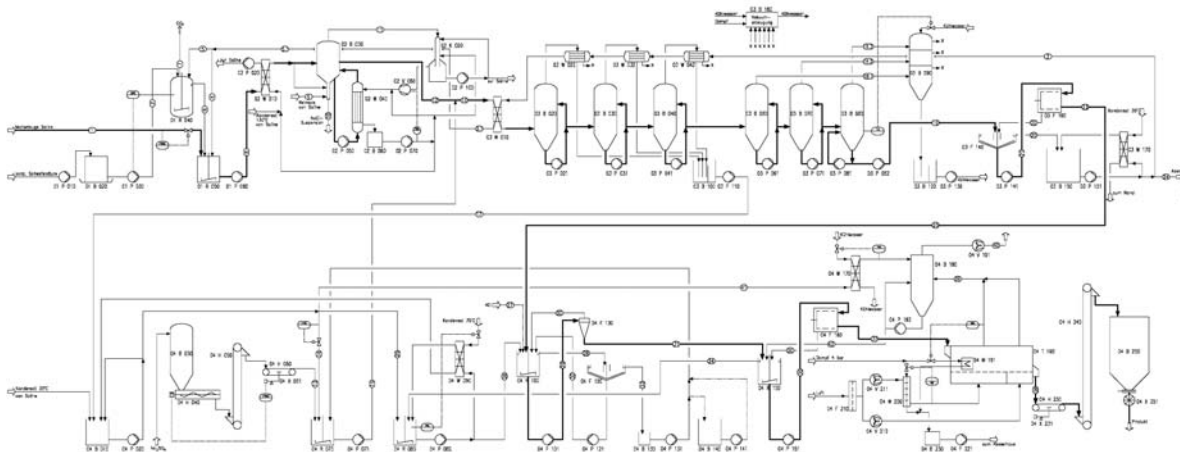
Process Development, Process Testing

Process Design and Basic Engineering

For any Field of Application

We develop “tailored” solutions for any case of application proceeding from original raw materials by the following course of processing:

- Bench scale crystallisation test work in our test field with different sizes of apparatuses (20 l, 100 l, 400 l,) with raw materials, provided by the client.
- Crystallisation test work at the client’s facilities in bypass operation to the process with materials taken directly from the running plant. Apparatus capacities of 100 l, 400 l and 1000 l are possible (rental apparatuses).
- Evaluation and assessment of product samples.
- Recovery of all necessary process data from continuously running test work.
- Process development for any specific application.
- Process Design
- Basic Engineering
- Commissioning of industrial plants, carried out by experienced **K-UTEC** employees.



K-UTEC Test Field and Company Estate



K-UTEV-Precipitation Crystallisers in Operation

