

Crystallization

One of the most important processes
in sugar factories and refineries



Targeted control of the crystallization process allows precise adjustment and control of the desired properties. Certain processing aids play a crucial role in this process, including:

Slurry – for the initial stages of crystallization

Viscosity reducers – for better mixing of the solution
and thus better crystal formation

Color reducers – to control color intensity



The right crystallization makes the difference

An essential process to improve quality and ensure safe sugar production

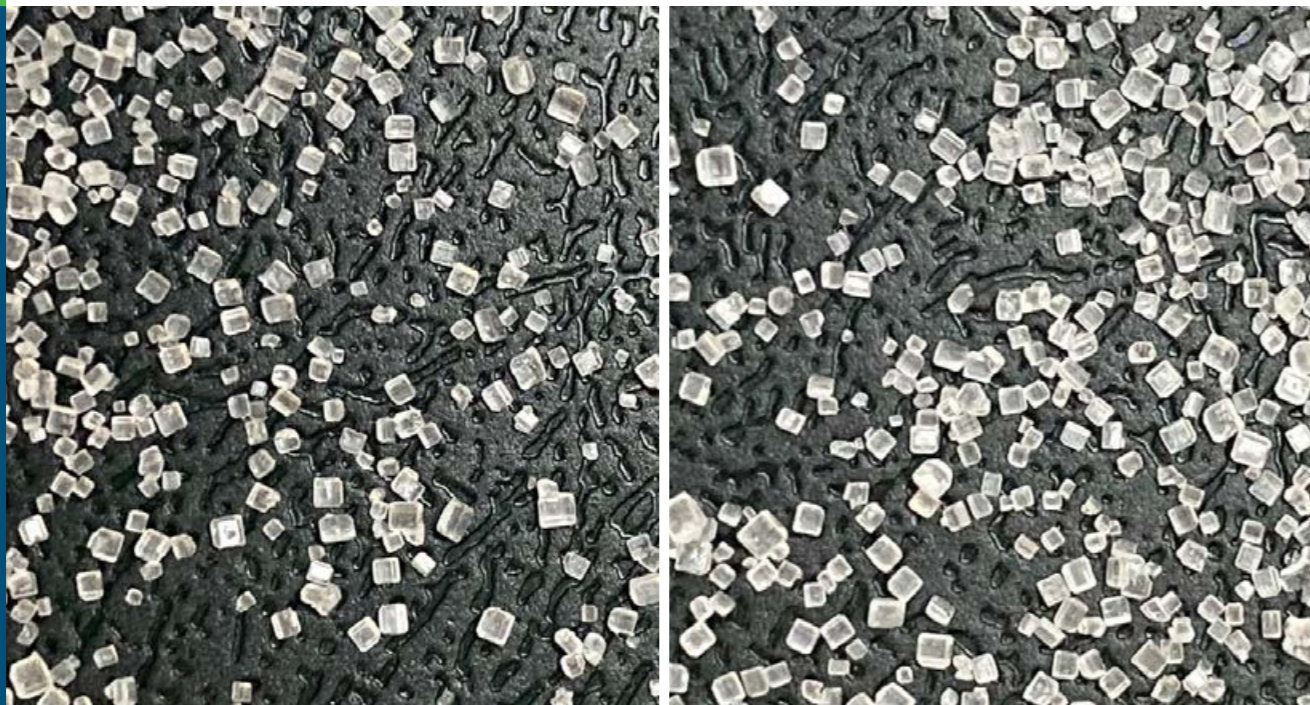
Crystallization is a natural process of which almost all pure substances are capable. In the process, the substances enter a state of higher order in order to escape the chaos of their environment. On the one hand, this process takes place spontaneously in nature, for example when salt crystals form on evaporating pools of seawater or when lava solidifies and forms basalt columns, as it does on Iceland. On the other hand, in the chemical and pharmaceutical industries as well as in the food industry, crystallization is brought about and controlled in a targeted manner to obtain the active ingredients, drugs and foodstuff in the desired quality.

In general, crystallization is used here for purification, separation and extraction of the desired raw materials.

Crystallization is also a quality-determining process in sugar production and refineries

Effective and efficient crystallization ensures high quality and safe production.

Microscopic images of a crystallite



Crystallized material - poor quality on the left and good quality on the right.

Uniformity of the fine grain, content of crystal aggregates as well as crystal morphology.



Crystallization - a quality-determining process in sugar production and refineries

Crystallization is of crucial importance in the efficient production of high-grade sugar of the desired quality. An optimal crystallization process leads to efficient production processes, improved yield and competitiveness in the sugar industry. This controls:

Quality of the sugar crystals

Crystallization is where the quality characteristics of sugar crystals are determined: Purity and size. Impurities remain in the mother liquor and the crystal size determines the possible use of the product, e.g. as household sugar or as "rock candy".

Separation of sugar and liquid

The separation of sugar crystals from the surrounding liquid, the mother liquor, takes place in centrifugation and, if necessary, in a washing step. After this, the sugar can be dried.

Yield optimization

Controlled crystallization ensures the maximum yield of the desired sugar crystal quality grades. This minimizes the loss of valuable raw materials.

Energy efficiency

Only a high degree of control over the crystallization process allows efficient use of energy. Recrystallization processes are minimized and energy consumption is reduced.

Die Crystallization is of crucial importance when it comes to ensuring quality, maximizing yield and minimizing energy consumption. A well optimized crystallization process leads to efficient production processes, improved yield and competitiveness in the sugar industry.

KEBO SLURRY

Optimum control over crystallization

For increasing quality and maximizing yields in the sugar industry

KEBO SLURRY ensures improved nucleation, controlled crystal size and improved crystal purity. Losses are thus reduced.

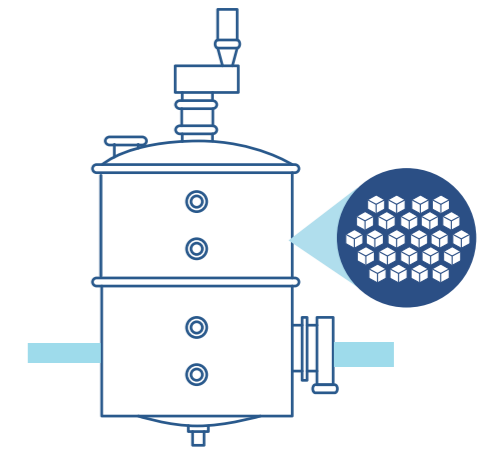
Features of KEBO SLURRY

- ➔ **Optimized particle size and low dispersion:** The particle size is optimized for use in the sugar industry. The low particle size distribution ensures a low CV value.
- ➔ **Stability of the SLURRY suspension:** It ensures easy handling of the SLURRY. Compared to isopropanol suspensions, sugar particles sediment much more slowly. The right combination of particle size and choice of liquid prevents agglomeration of the particles and ensures homogeneous distribution.
- ➔ **Low agglomeration or homogeneous distribution:** Uniform distribution of solid particles in the liquid means that the particles should be well dispersed and not aggregated or sedimented. Homogeneous distribution ensures efficient processing and prevents problems such as clogging in pipelines or pumps.
- ➔ **Proper viscosity:** Viscosity should be matched to the specific application and desired processing. Optimum viscosity facilitates the transport of the SLURRY as well as pumpability and handling in the processing equipment.



Essential measured values in the crystallization process

Monitoring and control of the below mentioned measured values during the crystallization process enables timely adjustment of the process parameters and efficient control of the process to achieve optimum crystal quality and maximum yield.



The CV value

- ➔ It indicates the degree of variation in crystal size distribution in a sample. A low CV value indicates a low variation in crystal size, which is often desirable in the food industry because a uniform crystal size can lead to better texture and quality of the final product.

Formula for CV value calculation:

$$\frac{\text{Standard deviation of crystal size}}{\text{Average crystal size}} \times 100$$

The MA value

- ➔ The average Mesh Size (MA) indicates the size of the sieve opening through which 50% of the sample crystals fall and 50% remain. The MA test uses cumulative percentages to determine which particle sizes are retained by a series of sieves, plotted on a graph showing the sieve openings along a straight line. This graph can be used to determine the MA and CV values. In general, coarse crystals are easier to centrifuge. Very fine crystals, on the other hand, easily pass through the centrifuge sieve and remain in the mother liquor, which must be recrystallized. This reduces the yield.



The fine dust content

- ➔ Dust is undesirable during crystallization, but cannot be completely avoided. Fine crystals appearing as fine dust after centrifugation are an indication of defects during crystallization, but are usually centrifuged off and must be melted down. If fine dust is found in the finished product, centrifugation was also defective. In general, fine dust is undesirable for safety and quality reasons.

KEBO SLURRY

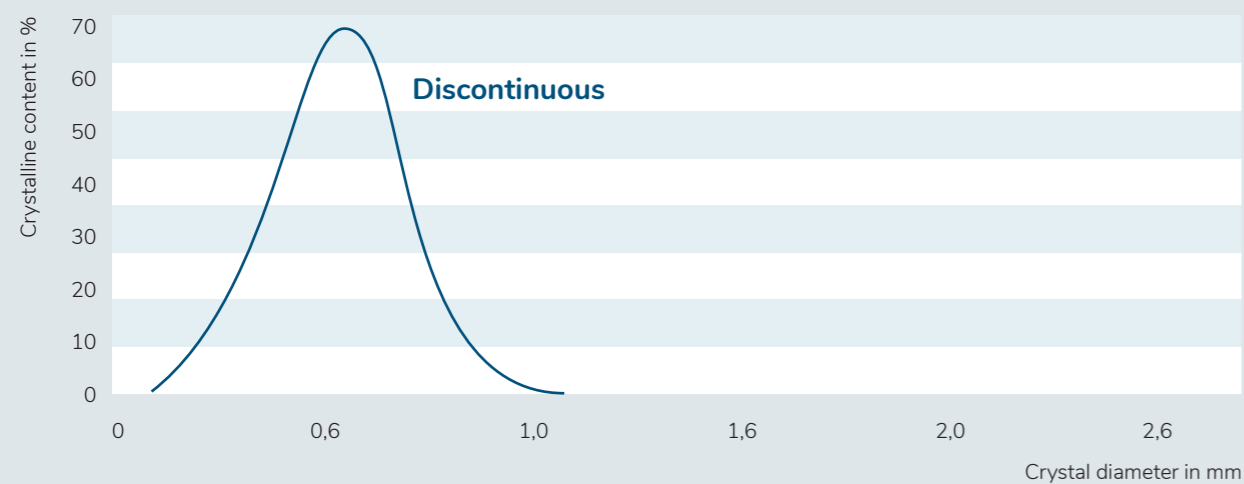
for uniform sugar growth

Defined sizes: With KEBO SLURRY to a desired, stable MA value, a low CV value as well as more sugar in the desired quality grade

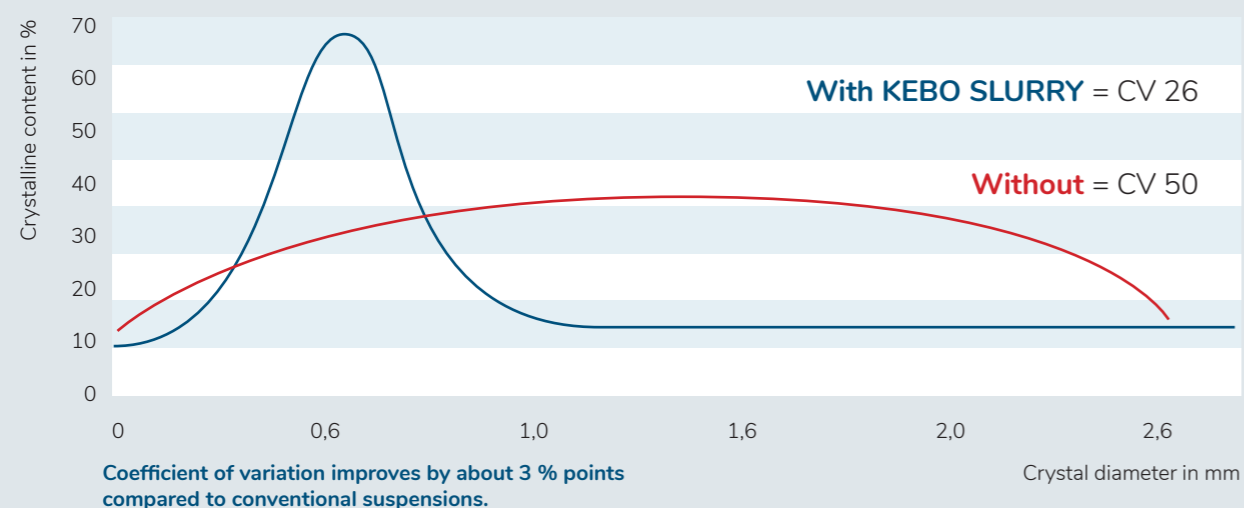
KEBO SLURRY is a ready-to-use mixture of finest, uniformly ground sucrose particles suspended in a highly viscous liquid. The use guarantees a particularly homogeneous crystal growth, which in turn leads to defined sizes and low distributions in the sugar crystals.

The use has been tested both in the sugar factory and in the sugar refinery.

Evaporation crystallization with KEBO SLURRY

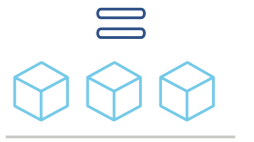
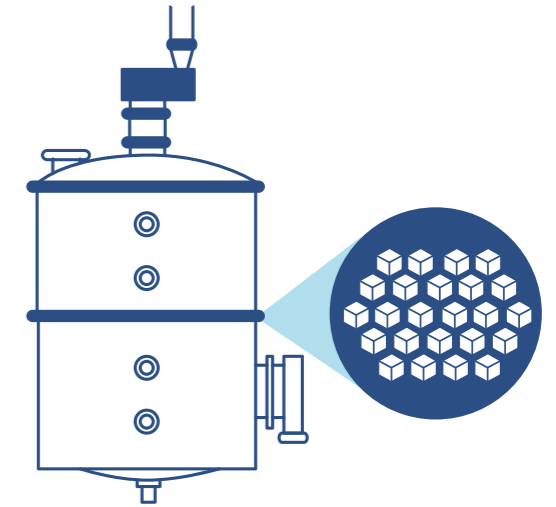


MA value control at low CV value with KEBO SLURRY



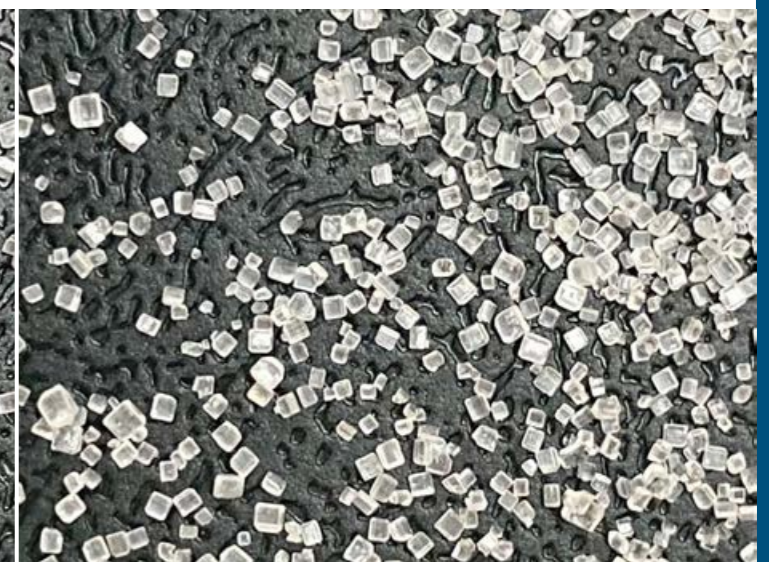
The clear advantages of KEBO SLURRY

- ➔ **High efficiency** or reduction of molasses loss, resulting in a high yield of additional sugar.
- ➔ **Excellent MA control:** Coca Cola-Standard 0,7 mm.
- ➔ **Lower and therefore better CV value:** Coefficient of variation improves by about 3% points compared to conventional suspensions.
- ➔ **Whiter texture of the sugar crystal:** The low CV value in sugar crystallization results in a whiter color and more uniform sugar texture.
- ➔ **Kosher and Halal Certified:** **Kosher-KLBD: 339647 and Halal-PID: 0405.** Sugar crystals suspension takes place in crystal seed suspension, not in isopropanol alcohol.
- ➔ **High stability:** The particle size distribution is very narrow. When freshly stirred **KEBO SLURRY** is stable much longer than isopropanol suspensions.
- ➔ **Economical:** About half of a KEBO SLURRY is needed compared to conventional seed suspensions with isopropanol.
- ➔ **Stability during storage:** Temperatures between -20 °C and +30 °C have no effect on quality, as measured by the results of the cooling crystallization test.
- ➔ **Ready to use:** Ready-to-use solution with a fixed sugar content.



After crystallization process with isopropanol SLURRY

After crystallization process with **KEBO SLURRY**



KEBOSOL CA Viscosity reducer and defoamer

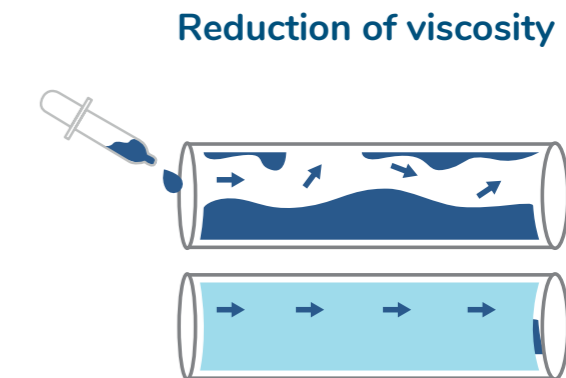
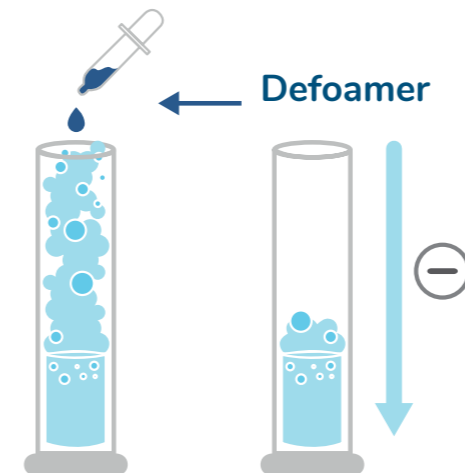
Crucial for the control and optimization of crystallization processes

Reducing the viscosity of the sugar solution has a direct positive influence on foam formation, flowability and crystal formation as such.

KEBOSOL CA reduces the viscosity allowing better mixing of the solution and thus better crystal formation. The use of KEBOSOL CA leads to energy savings, allows the process to run at a higher density and generally stabilizes the process of crystallization.

Kebosol CA reduces the viscosity of the mixture in the vacuum pan. It provides easier handling, better mixing, more stable crystallization and better flowability.

- ➔ **More efficient utilization of the available volume in the vacuum pan:** With improved filling and lower viscosity of the sugar solution
 - a) the mixture is more flowable and easier to handle
 - b) more efficient mixing of the ingredients and better crystal formation is possible.Thus, more sugar fits into the vacuum pan, resulting in larger batches for the same pan volume.
- ➔ **Facilitating crystal formation:** A lower viscosity value facilitates the movement of solid particles within the liquid, resulting in improved mixing and a more even distribution of crystallization nuclei in the sugar solution. This in turn promotes faster and more uniform crystal formation.
- ➔ **Reduction of clumping:** Too high a viscosity value can lead to clumping or agglomeration of the solid particles in the thick juice. This in turn can affect the efficiency of crystal formation and lead to uneven crystal growth. By adding a viscosity reducer, the solid particles are better dispersed and clumping is minimized.
- ➔ **Increasing the flow rate:** Lower viscosity of the thick juice allows for a higher flow rate through piping and equipment components, improving the productivity and efficiency of the crystallization process.

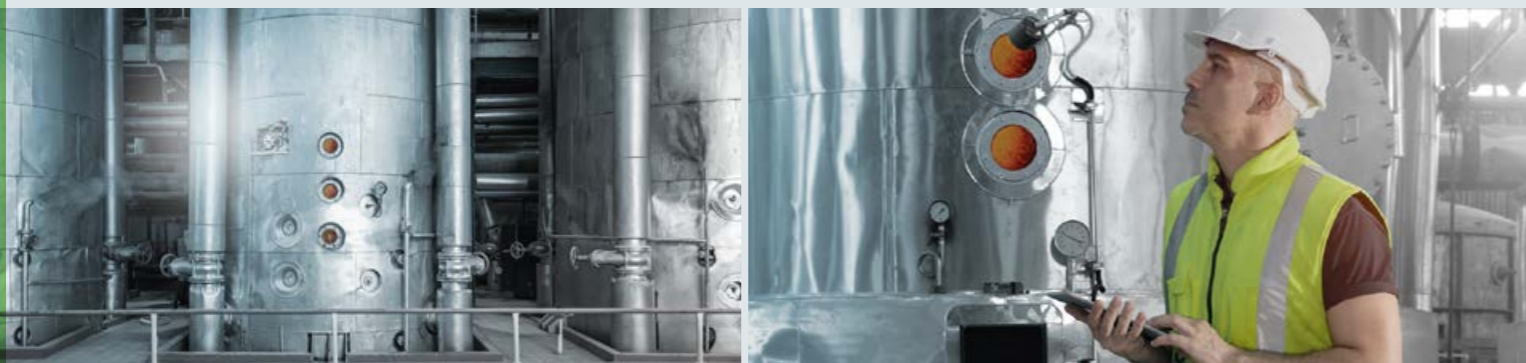
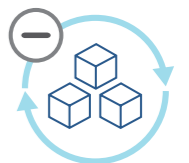


KEBOSOL CA at a glance

- ➔ **Viscosity reducing and defoaming:** The surface tension of intermediate liquids is reduced.
- ➔ **Faster crystal growth** due to noticeably improved filler circulation and immediate and lasting defoaming effect (boiling).
- ➔ **Optimum use with:**
 - Vacuum pans** – resulting in better circulation of the Massequite white sugar filling masses and thus homogeneous and uniform crystal growth. Due to its anti-foaming properties, contamination of the condensate by excessive foaming can be prevented
 - Centrifugation** – resulting in rapid and complete separation of sugar crystals and molasses
- ➔ **Higher desugaring in the post-product mashes** as well as better flow characteristics in the mash batteries.
- ➔ **Faster “strike-through” of molasses** in the discontinuous centrifuge and striking improvement of the centrifuging and covering process in the continuous centrifuge, as well as faster and complete deaeration of molasses (centrifugability).
- ➔ **Ready to use** – Ready dosed, non-ionic surfactant, ready to use at 20 °C room temperature.
- ➔ **Easy and fast application** – Due to its properties it can be added directly to the intermediate liquids.
- ➔ **Low Dosage** – Just 10 - 15 ppm KEBOSOL CA is sufficient to achieve optimum viscosity or foam reduction.



Less loss during centrifugation



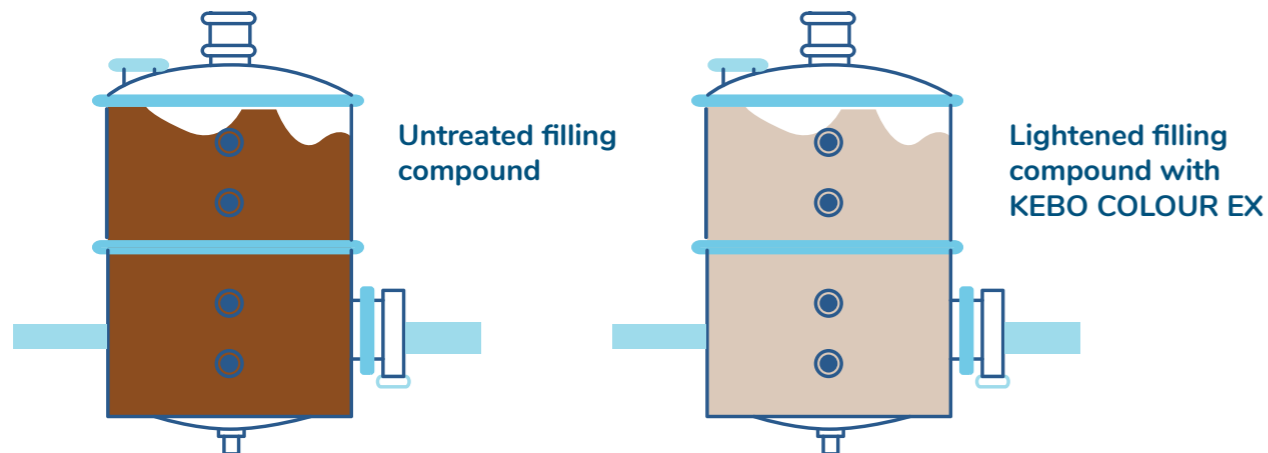
KEBO COLOUR EX

The sugar quality based on various criteria such as color, purity, moisture, granulation and filterability

Color is one of the most important characteristics for the sugar quality, as it is directly related to its purity. Colorants from molasses and other impurities can also remain in the sugar crystal after crystallization. KEBO COLOUR EX destroys color molecules and is able to lighten the product when used during crystallization.

Color reducer to lighten the filling compounds and to bind and remove impurities

During the crystallization process, various organic compounds and impurities may be present in the sugar suspension. These impurities can lead to an undesirable dark color of sugar.



KEBO COLOUR EX at a glance

- ➔ **Strongly acting reducing agent** – based on a selected sulfur-containing compound. The lightening of the filling compounds is based on the reduction of chromophoric groups of sugar compounds.
- ➔ **KEBO COLOUR EX decomposes without residues** when exposed to moisture and heat during drying of the sugar crystals.
- ➔ **Rapid processes** – KEBO COLOUR EX is drawn into the cooking apparatus in a dry, powdery state (without pre-dissolving in water) immediately after sugar crystallization is complete, through the vacuum.
- ➔ **Proper storage:** This ensures the dry and powdery state of KEBO COLOUR EX.
- ➔ **Kosher and Halal Certified:** Kosher-KLBD: 339647 and Halal-PID: 0405

High-quality products from KEBO for optimum process flows and results in crystallization



To implement better the crystallization process in its timing, these important points must be considered simultaneously:

- ➔ **Proper quantity:** Accurate proportioning of ingredients, including sugar, is critical to achieve the desired yield and quality of the final product. Accurate quantity matching is important to achieve the desired crystal properties.
- ➔ **Proper timing:** The timing of adding processing aids or performing certain steps in the crystallization process is critical. This relates to controlling temperature, agitation or other parameters to control the process optimally.
- ➔ **Proper concentration:** The concentration of the sugar solution based on the Brix value determines crystal formation and growth. An optimal concentration resulting in the desired crystal structure and quality should be carefully determined and monitored.
- ➔ **Proper particle size and distribution:** The particle size and distribution of sugar crystals determines the texture and quality of the final product. Specific control of crystallization conditions, including mixing and rate of crystal growth, will ensure the desired particle size and distribution.
- ➔ **Proper quality and high stability of the suspension:** The quality of the materials used, including the sugar and other ingredients, is important to ensure optimal crystallization. In addition, the stability of the suspension is important as it affects the balance between dissolved and crystallized sugar.
- ➔ **Avoidance of spontaneous crystallization:** Spontaneous crystallization outside the desired process can lead to undesirable effects. It is important to create suitable conditions to allow specific crystal formation and to avoid uncontrolled crystallization.

Chemistry is our passion



An effective response for every requirement: not only chemical, but also very personal

We are a globally active company in the specialty chemicals industry. With almost 100 years of tradition, we stand for quality, service orientation, reliability and innovation.

When it comes to operating your production plants, KEBO products and services ensure clean processes. We meet all challenges related to chemical cleaning processes, water treatment and corrosion protection - whether for the sugar industry, for the production of ethanol, starch, yeast or for the steel industry. We see ourselves as a partner to our customers and provide our knowledge on an equal footing. Trust, responsibility and respect are our guiding principles in dealing with colleagues, customers and nature.

Our services for you:

- Advice from our chemists & engineers in application technology and, of course, also in your planning of the necessary apparatus and operating equipment
- A worldwide network of competent sales partners who are available to assist you directly on site in analysis, planning and implementation



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