Sucrose alternatives

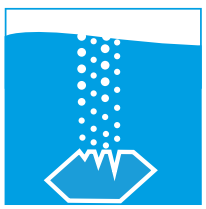
The crystallisation of sugar substitutes –
from the laboratory to industrial production.

From the laboratory to industrial production

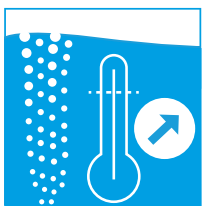
Because of their respective chemical structures, polyols have different chemical and physical properties. Individual sugars and sugar substitutes therefore differ also in terms of their solubility, crystal growth and crystal shape. This requires different approaches in crystallisation and in all other process steps.

Information about solubility is a basic requirement for carrying out systematic crystallisation tests. Unlike pure solutions, technical solutions are subject to process-based and raw material-dependent contaminations. As these contaminations have an impact on the solubility of the main constituent, a first step is to determine exact solubility data as a function of the purity, dry substance content and temperature of the solution in the laboratory. With these data, the basic parameters for crystallisation tests can be established and first estimates of the crystallisation process made. Laboratory-scale testing is used to determine or verify material properties for the configuration of the crystallisation processes and the apparatus; to rate crystallisation properties; and to assess the feasibility of crystallisation trials on the pilot scale. If required, testing can include the complete process chain – from evaporation to crystallisation and separation, to drying.

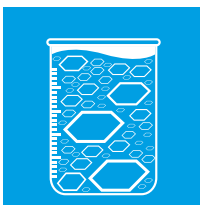
Material properties



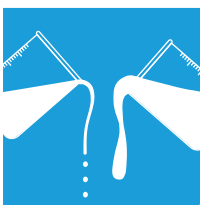
Solubility



Boiling point increase

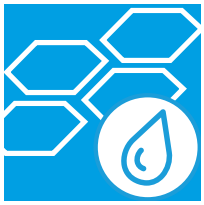


Density

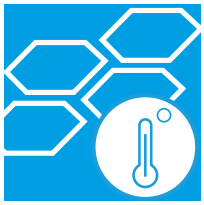


Viscosity

Process data

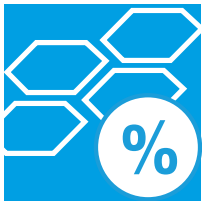


Dry substance content



Temperature

Crystallisation speed



Crystal content

Crystal size and distribution

Output

Sugar alcohols in the polyol group

++ Erythrite/erythritol
++ xylite/xylitol
++ mannite/mannitol ++ sorbitol ++ maltitol ++ lactitol ++ isomalt ++

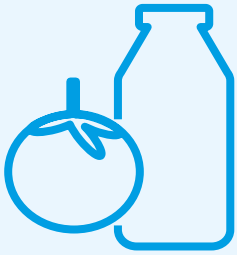
Sugar substitutes

Carbohydrates with added value

BMA has been a leading manufacturer of machinery, plants and equipment for the production of sucrose, glucose and fructose for many years, and has unrivalled knowledge of processes and process engineering. We successfully use this knowledge for the crystallisation of a range of sugars and polyol-group products.

Like sucrose, sugar substitutes belong to the group of carbohydrates. From a legal point of view, they are sweeteners, classified as sugar alcohols (polyols) because of their chemical structure. One of their main characteristics is their sweet taste. Although they are less sweet than sucrose – between 40 and 80 % depending on the product – the taste profiles of some sugar substitutes are very similar to that of table sugar. Demand for crystalline forms of sugar subastitutes is growing, and not only for use as sweeteners. Areas of application range from the food sector to pharmaceuticals and cosmetics, and to the chemical industry.

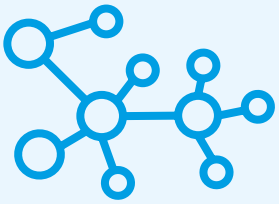
Sugar substitutes are used in a number of industries:



Food industry

Pharmaceuticals

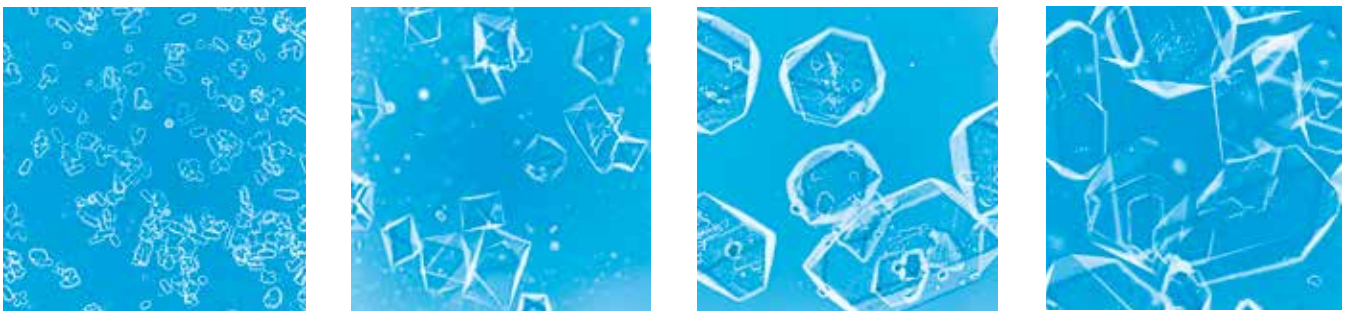
Cosmetics



Chemicals

Application-specific testing methods

BMA uses specific testing methods to assess the crystallisation behaviour of different sugars, recommend variations of technical processes, design apparatus and equipment accordingly, and adapt them for the specific properties of the different sugars and sugar substitutes. Crystallisation processes are chosen depending on the product properties. Both pan boiling and cooling crystallisation can be tested on the laboratory and pilot scale, either individually or together in a process chain.



Changes in the morphological properties of a crystal during crystal growth using the example of a monosaccharide.

Impulses for technical implementation

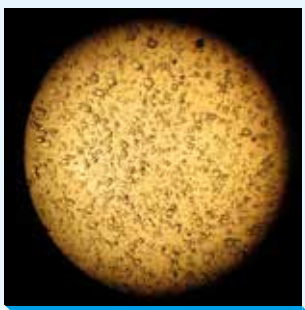
Continuous and batch-type pilot tests in the BMA research centre serve to verify the results of laboratory tests, and to determine and optimise process parameters. Pilot test results serve as proof of technical feasibility of process steps on an industrial scale and for the configuration of the apparatus and machinery.

Pilot-scale testing is an important step in the planning of a large-scale crystallisation plant. Crystallisation trials at the research centre can be combined with additional tests such as on heat transfer or the sedimentation behaviour of crystal suspensions. In these scale-ups, larger volumes of massecuite and mother liquor are produced, permitting specific separation and drying tests. The separated mother liquor is used for further tests on crystallisation behaviour and on increasing output. Based on the results of laboratory and pilot-scale testing, the basic concept marks the first step in the planning stage of a crystallisation plant.

For technical implementation, machinery, apparatus and process parameters are adjusted to match product-specific characteristics. Relying on the documentation from basic or detailed engineering, BMA can supply equipment to implement an entire project, from evaporation to crystallisation, to separation, and to drying.

Laboratory and pilot-scale process steps:

Evaporation



Crystallisation

Separation

Drying

BMA research centre

Research and development at your service

Work in the research centre focuses on crystallisation methods for a variety of sugars and sugar substitutes. Pan boiling and cooling crystallisation tests are run on a laboratory and pilot scale in batch-type or continuous mode.

Another focus is on thermal methods for drying a variety of products for the biomass and food industries. Our research centre features a scaled-down steam dryer, which uses superheated water vapour for energy-efficient drying.

We also test the mechanical separation of solids and liquids, processes that are used in extraction or centrifugation in sucrose production.

BMA service: from the first consultation to the finishing touches

Whether you require assistance with plant design, traditional mechanical engineering, automation technology or post-installation services – with BMA, your project could not be in better hands. Right from the start. Together with you, we develop the perfect solution for your requirements, assisting you from the first concept until the final bolt is in place and your plant is running at full speed. And throughout the life cycle of your plant.

1 CONSULTING

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3 MANUFACTURE

4 COMMISSIONING

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BMA – Passion for Progress

For over 160 years, BMA has been developing and manufacturing machinery and equipment for industrial-scale sugar production. BMA system solutions for sugar factories and refineries are in demand wherever minimum energy consumption and consistently high product quality are top priorities. With a more than 800-strong workforce around the globe and in-depth knowledge of process engineering, BMA has an exceptional service profile in the sugar industry.

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