facts

A novel, sugar-free binder syrup for healthier snacks

Jungbunzlauer

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Introduction

A spotlight has been cast on added sugars in food systems and the desire for alternative options to sugars has become more pronounced. In snacks and convenience foods, taste is one of the primary drivers for consumption. Simply removing sugar without a replacement is not always an option.

For certain applications, sugar-based ingredients provide sweetness, flavour and also functionality. In many snack foods, sugars are used to bind and coat food particles together in a cohesive matrix. Granola and snack bars are examples. Thus, achieving the same functionalities like sugar is as important as achieving a nice sweetness and flavour in a sugar reduced or sugar-free formula. In the following a sugar-free binding system is presented that delivers on all these aspects.

ERYLITE®, Xanthan Gum and crystallisation

ERYLITE® is erythritol produced by yeast fermentation. It has become popular as a replacement for sugar in many applications. The use of ERYLITE® in novel, sugar-free binder syrups extends that range of applications and it serves as a useful tool for formulators.

ERYLITE® has a clean taste, low calories (0 - 0.2Kcal/g depending on regulations) and high digestive tolerance, which makes it appealing for many applications. However, it tends to have a cooling effect when in crystalline form and also has a lower solubility than sucrose. In part with this reduced solubility, it has a tendency to re-crystallise when at concentrations above 30% (at ambient temperatures or lower).

In order to use ERYLITE® to replace sucrose in several applications indicated below, the crystallisation of ERYLITE® will need to be addressed.

The avoidance of crystallisation in sucrose systems is known. Oils, fats, waxes, and hydrocolloids have been employed to prevent crystal formation. Physical parameters, such as controlling heating and cooling of the system will also help with controlling crystallisation. These techniques are demonstrated mainly in confections and frozen novelties.

To prevent the crystallisation of ERYLITE®, some of these same techniques can be employed. We will begin with the use of a hydrocolloid.

Xanthan gum is a hydrocolloid with properties that lend themselves towards this application. At the intended use levels, it is low in calories. Only a very small amount of xanthan gum is required to increase the viscosity of a system.

Xanthan gum is able to disperse and hydrate in both cold and warm systems. It does not form a brittle gel, but rather remains flexible and fluid. It also exhibits shear thinning properties, making solutions using xanthan gum easy to pour and pump. Xanthan gum may be able to impede and delay the formation of crystalline structures, such as ice or sucrose. This makes a concentrated ERYLITE® solution easier to work with.

The suspension properties of xanthan gum allow for any undissolved ingredients (spices, mineral salts, certain vitamins for example) to be uniformly distributed in the final application.

Xanthan gum can aid with moisture retention and retain structure in bakery systems. When used on the surface of a system and subsequently dehydrated, it can help form a smooth coating. The combination of xanthan gum and ERYLITE® can bind particles of a food matrix together and result in a “glaze” on the surface of a food product.

In addition to the functionality of xanthan gum, salts of organic acids can also be of use when manipulating crystal formation in ERYLITE® systems. The addition of sodium gluconate to the above combination of xanthan gum and ERYLITE® further impedes the formation of the ERYLITE® crystalline structure.

Sodium gluconate, potassium gluconate and trimagnesium citrate have the ability to off-set the cooling associated with ERYLITE®. By incorporating one of these mineral salts into the formula, the final system will be better balanced to avoid cooling. Sodium gluconate works well as it is a mild tasting salt that is also able to help mask the lingering sweetness associated with the incorporation of high intensity sweeteners, such as stevia.

The texture of an ERYLITE® + xanthan + mineral salt syrup is not “sticky” like a sucrose-syrup. Instead, it has a smooth, silken texture. By lowering the water content or increasing the level of xanthan gum, this can go in the direction of a gel.

Sugar-free binder syrup / glaze

The basic formation of this syrup relies on some key principles:

1) Dissolving the ERYLITE® crystals
2) Hydrating the xanthan gum
3) Dissolving mineral salts (e.g. sodium gluconate)

For this application the whole ERYLITE® product range, ERYLITE® erythritol, ERYLITE® Bronze, and ERYLITE® Stevia are all suitable, depending on desired sweetness and flavour profile.

ERYLITE® best solubilises in conditions with heated water. Dissolution of ERYLITE® lowers the temperature of the solution medium. For example, the incorporation of 60g of ERYLITE® into 78g of boiling water (100°C) will drop the temperature of the water to 37.7°C. As the temperature of the water drops, ERYLITE® will become less soluble.

In order to ensure all ERYLITE® is completely solubilised and no seed crystals remain, dosing ERYLITE® into water that is being heated and agitated is ideal. Some small amount of care may be necessary to remove any material that is on the side of the vessel or top of the agitator.

This can be performed on a heated stir-plate or an apparatus such as a ThermoMix®. A jacketed kettle with proper agitation can be used on a larger level for scale-up.

Once ERYLITE® is dissolved, xanthan gum can be added. The level of xanthan gum added depends on the desired principles of final application for the syrup. For example, a standard 80 mesh xanthan gum (such as Jungbunzlauer xanthan gum FN) can be used at 0.5% for topping adhesion, whereas a clear surface glaze may be more suited to a transparent xanthan gum (such as Jungbunzlauer xanthan gum FNCS) at 0.25%.

It may be best to incorporate xanthan gum with a granular ingredient, such as the mineral salts. By lightly mixing the dry xanthan gum with a granular ingredient, it will incorporate much more readily with the ERYLITE® solution.

Once the 3 key ingredients are incorporated, it is best to ensure the entire mixture reaches 85°C. This is a temperature that is suitable for hot-filling containers and will control microbes of concern.

If there is a desire to store the syrup for future applications, the incorporation of an acidulant (citric acid or lactic acid for example) to decrease pH is an option. Other preservation agents could also be employed at this time if desired.

The syrup can be poured into jars, bottles or other vessels when it is still hot. If the vessel is appropriately sealed, the syrup will remain liquid.

180 days of shelf life data has indicated that the syrup can remain liquid without crystal formation when stored at ambient temperatures (20-24°C), elevated temperatures (40°C), and freezer temperatures (-7°C).

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What type of applications is this suitable for?

Glaze for snack mix

Glazed snack mixes for nuts, seeds and fruits typically rely on oil coatings or sugar coatings. There are some products that rely on a blend of oils and sugars. These can result in increased fat content and calories. In this application, a basic glazed snack mix can be produced using no added oil or sugar.

The syrup is prepared as previously indicated. For products where a salty flavour is desired, sodium gluconate can be added to the system through a salt substitute, such as sub4salt® (comprised of salt, potassium chloride, and sodium gluconate). In addition to providing the system with sodium gluconate, sub4salt® allows for full salt flavour with lower sodium content. Flavourings, dry ingredients (spices, seasonings, colourants), and other desired ingredients can be dispersed in the syrup prior to addition to the larger particulate components of the mix. Larger dry particulate materials, such as nuts and seeds, can be portioned and added to a mixing vessel such as a planetary mixer. The syrup blend can then be added to the larger particulate blend during agitation to ensure even coating.

The glaze is set on the snack mix through heating. Ideally, the application of heat combined with air movement, such as in a dehydrator or a convection oven, helps to accelerate the process and provide a uniform product. If a tumble-heating process is available, that ensures the most uniform drying option. Mixing and flipping the snack mix at intervals during the heating process ensures even coating and drying.

Heating at a temperature below 149°C will avoid burn-on and aid in the retention of certain flavour compounds. For some applications, it may be desirable to maintain the temperature below 93°C and allow the material to heat for a longer time to preserve flavour and texture.

Adhesion / cohesion of food components for formed bars and clusters
In this example, the syrup can function as “edible glue” between the particles in a food system.

This is similar to the glazing option indicated above, but using a different level of particulate to glaze ratio and a slightly modified heating ratio. The addition of soluble fibres can also change the texture towards more “chewy” vs. “crunchy.”

Direct examples could include the formation of a snack bar or “cluster” snack product that may include nuts, seeds, grains, fruits, protein crisps and other potential ingredients of interest.

When the syrup is added to flours or finely milled ingredients, such as almond meal, it functions somewhat like an egg-replacer. This can be used to form crackers, cookies and other snack foods that can be baked.

Another route would be to take a central food component (such as a fruit or vegetable) and dip it in the syrup and roll it in another component for a surface coating. This could apply to something such as panko breading baked vegetables or a snack product with a crunchy outer layer of nuts.

When made using ERYLITE® Bronze and a bit of sub4salt®, the bars, clusters or cookies would take on a flavour similar to brown sugar and toffee.

For topical ingredient application (such as adhering seeds to a baked good or toppings to a pizza), an option is to fill a food-grade “syringe” with the syrup gel and then apply a small bead between the two surfaces.

Dried fruit and fruit preserves

The final application example to be explained here will be the use of the syrup for the osmotic dehydration of fruits and vegetables.

Many fruits and vegetables contain a significant amount of water as part of their interior matrix. Drying of fruits and vegetables has been a fundamental part of food preservation. In some applications, a dry, crunchy product is desired, whereas, for others, “chewy,” “juicy” and softer textures are more suitable.

Osmotic dehydration is used as precursor step to drying certain fruits and vegetables. This uses principles of solute concentration disparities to remove free water from the interior of a fruit or vegetable and transfer solutes into the cells, which help maintaining structure and texture upon drying. Traditionally, hypertonic sugar solutions have been employed for this application. Soluble fibres also can be helpful here, but they don’t necessarily impart the desired sweetness and typically need to be accompanied by an additional sweetener.

The aforementioned syrup blend comprised of ERYLITE®, xanthan gum and sodium gluconate can serve as a tool in this process.

Fresh or previously frozen fruits are added to the syrup with a starting Brix reading of about 38-40°. Brix readings of the syrup indicate a steady drop in concentration over the first 12-48 hours. This is similar to how a sucrose or juice-based version of this system would behave. It can also be noted that the appearance of the syrup will go from colourless and transparent to taking on the natural colour profile from the pigments in the fruit.

The osmotically dehydrated fruits will take on the sweetness of the syrup and will have a nice plump texture. These can be treated with an acidulant for flavour and pH reduction (as needed) and then canned, refrigerated, or frozen for various food applications.

Upon draining the fruit from the infusion syrup, the fruits can be dried at 149°C for 20- 30 minutes at a time, with flipping / movement to facilitate even drying. The resulting fruit behaves quite similar to fruit that has been osmotically dehydrated using a sucrose solution. A safe target water activity level can be achieved while avoiding a dried, tough texture. No visible signs of surface crystallisation are observed. This dried fruit can be used for applications such as bars, clusters, cereals, baking mixes and portable snacking.

The syrup that remains from the osmotic dehydration process also has potential applications and can be processed as infused syrup for applications in desserts, beverages and frozen novelties.

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Conclusion

Reducing added sugars in food formulations, especially snacks and convenience foods, can be a difficult challenge. Access to new options and techniques can increase the success rate for food formulations.

A novel binder syrup formulation provides a sugar-free, non-sticky solution for certain food applications.

ERYLITE®, xanthan gum and sodium gluconate are obtained through carbohydrate fermentation. They each have their own unique properties, including sweetening, thickening and buffering. For the formulation of this binder syrup, the combination of these three key ingredients delivers functionality, texture and taste.

Glazed snack mixes, formed bars, and dried fruits are a small portion of the world of snacks and convenience foods. The syrup explained here can be used in a wide range of possible products.

More detailed information and recipe cards for the applications discussed here can be provided by Jungbunzlauer.

About Jungbunzlauer

Jungbunzlauer is one of the world's leading producers of biodegradable ingredients of natural origin. We enable our customers to manufacture healthier, safer, tastier and more sustainable products. Due to continuous investments, state-of-the-art manufacturing processes and comprehensive quality management, we are able to assure outstanding product quality.

Our mission "From nature to ingredients®" commits us to the protection of people and their environment.

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