WHY DOES TEXTURE, MOUTHFEEL AND PROLONGED SHELF-LIFE MATTER?

CONSUMERS EXPECT FOOD PRODUCTS WITH A SUPERIOR SENSORIAL PROFILE, BETTER FUNCTIONAL AND NUTRITIONAL PROPERTIES WITH EXTENDED PRODUCT SHELF-LIFE THAT ARE CONVENIENT TO PREPARE—WITHOUT COMPROMISING THE FOOD SAFETY PERSPECTIVE. BY **DR CHEAH HAN SERN**, TECHNOLOGY MANAGER, FUTURA INGREDIENTS.

SHELF-life is defined as the suggested maximum duration a food product can be stored, during which it is still safe for consumption. The texture and mouthfeel of the product remains acceptable to the expectations of consumers with the right conditions of storage and distribution. The stability and shelf-life of a food product can be affected by many factors, for instance, the quality of ingredients, product composition and structure, process conditions used during processing, packaging, as well as the storage and distribution conditions. Once these factors are identified and fully understood, one can have better control on preserving the quality of foods and at the same time extending the shelf-life of food products.

However, there are a number of deteriorative processes and factors that can limit the stability and shelf-life of foods and beverages. This includes microbiological spoilage, chemical deterioration and physical instability, moisture migration in foods, chemical or physical contamination, supply chain and distribution conditions to name the least.

Despite the technological progress we have made over time, there are continuous changes in consumer lifestyle choices. Consumers expect food products of superior sensorial profile, better functional and nutritional properties with extended product shelf-life, that are convenient to prepare, without compromising the food safety perspective.

Food spoilage is the main factor that renders a product undesirable or unacceptable for consumption. Here, microbiological activity is the most imperative factor influencing the changes that cause spoilage in food products. However, a number of processes have been established to prevent the microbiological spoilage of foods and beverages, amongst which low temperature storage and heat treatment are the most effective ways to stop, control or slow down the spoilage, whilst maintaining the nutritional value, texture and flavour of the products.

Besides the microbiological factor, the deterioration and spoilage of foods is related to chemical and physical changes, which can change the overall appearance, texture, flavour, and taste. A series of chemical and physical changes happens in foods and beverages during storage and within the distribution supply chain. Chemical deterioration such as lipid oxidation and hydrolysis cause rancidity and produce an off-flavour. Light-induced chemical changes, such as sunlight or fluorescent light, may cause photo oxidation of lipid and protein.

Temperature, water content, pH levels, oxygen, and light are among the key factors controlling these chemical deteriorations. By controlling these factors, chemical deteriorative reactions can be delayed during storage and throughout the food supply chain. Besides controlling temperature and water activity, the addition of ingredients such as sugar, salt, carbon dioxide, or antioxidants help in delaying food spoilage. The use of appropriate packaging is also important in maintaining the quality and shelf-life of a food product. Packaging protects the food from light, oxygen, temperature, moisture as well as microorganisms.

IN ICE-CREAMS AND FROZEN DESSERTS, EMULSIFIERS SUCH AS MONO- AND DIGLYCERIDES IMPROVE MELTDOWN RESISTANCE, INCREASE RESISTANCE TO SHRINKAGE.

On the other hand, physical changes or instability causes the overall deterioration in foods and changes in the appearance of beverages. This includes texture and mouthfeel that are deemed unacceptable to the consumers. Physical changes such as starch retrogradation, gelatinisation, fat bloom, ice crystal growth and emulsion breakdown are examples of physical deterioration during storage and supply chain distribution.

These physical deteriorations can be easily retarded by using ingredients such as emulsifiers and stabilisers. Starch retrogradation is the formation of ordered or recrystallisation of the polysaccharides in gelatinised starch, such as amylose and amylopectin. During baking, starch granules will swell and absorb water. This will cause the amylose transfers from an amorphous state into a soluble state, and the amylopectin from a crystalline state into a gelatinised state. During cooling of the freshly baked goods, amylose will retrograde immediately, and gelatinised amylopectin will recrystallise during storage. Starch retrogradation is the mechanism responsible for staling of baked goods, increasing firmness of the crumb structure, and cause loss of flavour in stale baked goods.

When Distilled Monoglycerides from the Ekömul MG or XTND Series and Sodium Stearoyl Lactylates from the Ekölite SL Series or Next Generation Crumb Softener, Ekömul NEXT Series are added, the emulsifier will interact with starch to form a helical inclusion complex with the amylose. This prevents further retrogradation or crystallisation of the starch during storage. Emulsifier-starch interactions, or starch complexing, is the crumb softening or anti-staling effect in baked goods. Starch complexing, which reduces the rate of staling of the crumb, is one of the most effective ways to promote softness in baked goods and at the same time to prolong the freshness or shelf-life of baked goods.

In chocolates and compound chocolates, a physical defect called “fat bloom” is very common. Fat bloom happens when low melting point fats migrate to the surface of the chocolate or compound chocolate, creating a state of recrystallisation, an unattractive grey appearance forms on the surface of the chocolate. Fat bloom causes the loss of surface gloss, followed by grey and white spots on the surface. This physical defect leads to a deterioration of texture, colour, appearance, and mouthfeel of chocolate products, and consequently, fat bloom causes the chocolate and compound chocolate to become unacceptable by consumers.

A number of different factors can cause fat bloom, such as improper processing conditions, compositions, storage and supply chain conditions. By controlling these factors, it will ensure the cocoa butter or cocoa butter substitute crystallises flawlessly to a state of crystal form or polymorph. This will ensure the appearance of chocolate and compound chocolate to be acceptable glossy, with fast melting form and still with a good snap effect. To achieve a longer bloom-free shelf-life, emulsifiers such as Sorbitan Tristearate from the Ekölite SE Series is often used in formulations for bloom prevention. In the past, research has shown that STS is effective at retaining the correct crystal form for a longer period, that also slows down the migration of low melting point fat fractions to the surface. As a result, STS prolongs the bloom-free shelf-life period for chocolate and compound chocolate.

Freezing is one of the most effective and common techniques used to preserve quality and shelf-life of food, as low temperature not only protects the food products from microbiological spoilage, but also slows down the rate of chemical deterioration. Therefore, during the freezing process,

food safety rarely becomes a problem, and most defects are related to the textural quality, the appearance and organoleptics of the food that takes place during freezing or during storage. For example, if growth of ice crystals and fat agglomeration in frozen desserts and ice cream are not controlled properly during freezing and storage, it will cause icy textures that leads to organoleptic and melt resistance deterioration.

These physical deteriorations can be retarded by using the appropriate emulsifiers and stabilisers such as the Ekömul KREM Series Texturising Systems which are excellent water-binding agents and is used to control the ice crystal growth and prevents the development of lactose crystals during storage, especially with temperature fluctuations.

Additionally, in ice-creams and frozen desserts, emulsifiers such as mono- and diglycerides improve meltdown resistance, increase resistance to shrinkage. Emulsifiers and stabilisers are commonly used to improve the body, texture and mouthfeel of ice cream. Therefore, by physical means, emulsifiers and stabilisers effectively increase the shelf-life of ice creams.

Most foods and beverages have an emulsion system. Emulsion is a mixture of two or more liquids, which one is present as droplets distributed throughout the other. These emulsions are either water-in-oil (W/O) emulsion, for example margarine and butter, or oil-in-water (O/W) emulsion such as cream and milk.

Emulsion is a thermodynamically unstable system, and over the time, this emulsion will collapse, leading to a phase of potential separation. This will cause the appearance, texture, and mouthfeel of foods and beverages to be unacceptable to consumers. Nevertheless, emulsion breakdowns can be retarded by using emulsifiers and stabilisers. Emulsifiers lower the interfacial tension between dispersed and continuous phases, while stabilisers thicken the viscosity of continuous phase, therefore this prolongs the food emulsion's stability.

All in all, the shelf-life of foods and beverages can be extended by reducing the microbiological spoilage, chemical deterioration and physical instability during food processing, storage, and supply chain distribution.

Speak to us at FUTURA INGREDIENTS to find out more on our wide range of emulsifiers, stabilisers and texturising systems that are able to retard the physical instability and deterioration of baked goods, oils & fats, ice cream and beverage products. APFI