Shelf Life of High-Moisture Confections

Using a marshmallow case study, a simple model for predicting shelf life due to moisture loss in high-moisture confections is described.

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High-moisture confections such as marshmallow are soft and pleasant to eat when fresh. When aged, however, these confections harden and are a challenge to chew. Although some people may age *Peeps* by opening the package several days prior to eating, when *Peeps* have fully petrified they are no longer acceptable. Jelly beans, caramel, fudge, creams, nougat, gummies and jellies are further examples of products that harden with age, eventually becoming sufficiently hard that consumers will no longer eat them. These changes occur naturally over time due to their high moisture content, especially in certain areas of the world.

In this paper, we discuss the changes that occur in high-moisture confections through a case study on marshmallow hardening. This case is based on a science fair project of Katherine M. Labuza while attending St. John the Baptist School, New Brighton, Minnesota. She stored marshmallows at RH values of 0 to 72 percent and evaluated both sensory and analytical measures over time to characterize the end of shelf life.

DETERMINING SHELF LIFE

With water activity values upwards of 0.7 to 0.75, high-moisture confections are prone to lose moisture when the relative humidity (RH) of the air is 60 percent or lower. When RH is as low as 25 to 30 percent, the rate of moisture loss out of the confections can be extremely fast, severely limiting their shelf life. This loss of moisture is what leads to the undesired hardening of confections. For high-moisture confections, storage in Climatic Zones I and III (Figure 1) will lead to significant loss of moisture, whereas the higher RH in Zones II and IV provides some measure of protection for changes associated with moisture loss. This moisture loss could be prevented by using expensive packaging solutions. For example, the candy could be stored in glass jars, metal cans or metal-clad laminated flexible films, none of which is a viable solution in most cases.

In high-moisture confections, drying out during storage leads to significant changes in texture and other important attributes of the candies during storage. As a marshmallow (or any other high-moisture confection) loses moisture to the atmosphere, it becomes firmer and firmer, so monitoring the change in texture is needed to find the critical point at which the product is no longer deemed acceptable.

Measuring Changes During Storage

For shelf-life testing, both analytical and sensory measures should be used to follow the changes over time. Numerous analytical measures can be considered, including those that give fundamental rheological properties and those that simulate consumption. Small angle oscillatory rheometry or texture profile analysis could be used to characterize ➤