How to Control Texture in Cultured Dairy

By Phillip S. Tong
December 1, 2011

The consumer can find a wide range of textures in fermented milk products. From drinkable to spoonable to spreadable – these foods are expected to exhibit textures of semi-solid gels, viscous liquids or thin liquids, depending upon the specific product (for example, fermented milk beverage, stirred yogurt, quark, etc.) and consumer expectations. Additionally, many fermented milk products must withstand mechanical shear (pumping and/or stirring) without any liquid separation. The foods almost always must have a smooth, creamy mouthfeel with or without milkfat in the formulation. And, don’t forget this rule: Thou shalt not be grainy!

Because consumers in part select such products based on textural attributes, they will not tolerate significant texture variation. Hence, gaining a more complete understanding of those factors that can influence fermented milk product texture is the first step to achieving consistent control and delivery of desired textural attributes.

To manufacture these products, we take a relatively stable protein, casein, and usually subject it to thermal processing and acidification via lactic fermentation to modify its structure, promote interactions with other proteins and create casein instability, which leads to its aggregation to form the gel matrix of most fermented milk systems. Once we have created a relatively delicate, unstable system, we try to fix this structure (stabilize it) and/or improve upon it to make desirable and lasting food textures consistent with the fermented milk product.

The first step is forming a gel at or near pH 4.6 by fermentation. In products that are not fermented in the finished package, we then gently agitate the sample, add other ingredients (sometimes) and then package. The firmness at initial gel formation (setting) becomes one of the key parameters to finished product texture for cup-set fermented milk products. However, stirred or vat-set fermented milk products with higher firmness at set will also have higher viscosity after shear (stirring), which is often desired. Fortunately, there are several tools available to dairy processors to stabilize the range of textures we desire in the array of fermented milk products. Ingredient, culture and process strategies are all utilized to develop and control fermented milk textures.

In fermented milk products, the array of dairy ingredients can complement the already functional components of the original milk to add structure, texture and stability. Supplementing milk with skim milk solids or milk protein concentrate adds casein, which after fermentation leads to a more dense casein gel network ( firmer gels). Adding whey protein concentrates can improve water-holding capacity, which leads to more viscous fermented milk products. For example, many Greek-style yogurts commonly have twice the protein of traditional yogurts, and these yogurts tend to rarely have any whey separation, can have very smooth and viscous textures and have little to no other ingredients to provide structural or textural stability. On the other hand, yogurts formulated with lower dairy solids can achieve good textural stability and smooth textures through the addition of starches, gums, pectin or other functional ingredients.

Processors also adjust the heat treatments given to the formulated milk base prior to fermentation to cause protein-protein interactions that can lead to more product stability (no wheying off) and higher viscosity without the addition of added stabilizing ingredients. If excessive high shear occurs to the fermented milk gel from pumping or stirring, this can result in very low-viscosity products. Additionally, for fat-containing milk blends, higher homogenization pressures lead to smaller fat globules and more casein at fat globule surfaces that can participate in the casein gel network formation. The result is
Firmer fermented milk textures/structures. Incubation times and temperatures impact structure formation and final pH, which affects texture.

Finally, a thoughtful selection of the culture to use in the fermentation process can make big differences on texture. There is a wide range of cultures that produce exopolysaccharides that act as natural functional stabilizers by enhancing product viscosity, interacting with water and other constituents of the fermented milk product.

If fermented milk product manufacturers remain cognizant of how ingredient, process and culture selection can impact product texture, they can effectively develop their manufacturing procedures to control texture and structure. Improved control of these factors will enhance product consistency to better meet consumer expectations.

Phillip S. Tong is professor of dairy science and director of the Dairy Products Technology Center at California Polytechnic State University.

Read More About Yogurt


Phillip S. Tong is professor of dairy science and director of the Dairy Products Technology Center at California Polytechnic State University.