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Using Dairy Proteins in Ready to Drink Beverages

The protein beverage market grew by 5.6% from 2015-2016 and is expected to grow by 6.1% from 2017-2020 (Euromonitor, 2017). The growth is coming from protein beverages in the categories of sports nutrition, adult nutrition, and meal replacement. The trends show that new introductions are focused on less sugar, clean label, higher protein levels, personalized nutrition, flavor innovation, weight management, and more plant based products. Protein beverages using a dairy source of protein are the most predominant. Dairy proteins continue to outperform plant proteins on flavor and functionality but that doesn't mean that dairy proteins are without their own challenges. It is important to understand some basic tips for working with dairy proteins to optimize their performance in a ready to drink beverage. The first tip is to understand the differences in functionality between whey protein ingredients such as whey protein concentrate and isolate (WPC and WPI) and milk proteins such as milk protein concentrate and isolate (MPC and MPI).

The pH of the drink is one of the main determining factors in your choice of protein. Casein is the most predominant protein in milk protein ingredients representing about 80% of the proteins while whey proteins are only about 20%. Caseins have good solubility and heat stability above pH 6. This attribute makes them the right choice for low acid beverages, which are typically about pH 6.8-7.0. In this pH range, ultra high temperature processing (UHT, temperatures of 284°F(140°C) for 3-6s) is necessary to make a shelf stable beverage. Though whey proteins have a good solubility over a wide pH range, they are not considered heat stable in the range of pH 6.8-7.0. It is possible to use whey proteins in a low acid beverage but it is always recommended to use them in combination with milk protein ingredients, which have more casein, than whey protein to optimize the protein stability. Caseins will interact with the whey proteins during the heating process, forming disulfide bonds, which will help chaperone the whey proteins through the heating process. This chaperone effect will improve their heat stability. The choice of milk protein ingredient might depend on cost or composition but MPC80, 85 and MPI are all good choices. To ensure you get the best heat stability and solubility out of your MPC or MPI it is necessary to make sure it is well hydrated. Hydration of high protein milk protein ingredients is very slow even once they are dissolved in water or milk. At cold temperatures, such as 45°F (5°C), MPC85 can take over10 hours to fully hydrate. At ambient temperature, 75°F (24°C), MPC85 will take about 6 hours to hydrate but only 1 hour at 120°F (50°C). A well hydrated protein ingredient will help ensure that it will remain soluble through the heating process.

Whey proteins are much faster to hydrate and will typically take only 30 minutes at cold or warm temperatures. Because whey proteins can denature at temperatures above 145°F (63°C), it is important to keep the water temperature below 145°F during hydration. Whey proteins can also denature with high shear, so use high shear only to dissolve whey proteins in water but then continue stirring with slow agitation during the hydration time. Whey proteins have their best heat stability at low pH so high acid beverages, those less than pH 4.6, are well suited for whey proteins. High acid beverages are typically hot fill processed (180F (82C) for 2 minutes) to achieve shelf stability. Their best heat stability and highest clarity (using a WPI) is achieved in the range of pH 3-3.5. At pH 3.5-4.5, whey proteins will need some help from a stabilizer like high methoxy pectin to provide more heat stability.

Beyond the dairy protein choice and hydration, there are many other formulation tips to developing a stable, good tasting high protein beverage. If you are interested in learning more, you can attend the Dairy Protein Beverages Short Course at the Center for Dairy Research on October 19. Visit www.cdr.wisc.edu for more information.

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