

Ready To Drink Protein Beverages

By Philip Connolly

How Milk Protein Dispersion, Hydration, and Solubility Affect Manufacture of Ready-To-Drink Protein Shakes

Milk protein powder is finding an increasing role as the protein of choice in ready-to-drink (RTD) protein beverages. To optimize the use of milk protein powder in RTD applications, it is important to properly disperse the powder into water or milk and properly hydrate the powder to maximize solubility of the powder. Failure to properly execute one or more of these steps will result in an RTD with undesirable organoleptic properties and a shortened shelf life.

Dispersing Milk Protein Powder into Milk:

A high-speed, high-shear mixer is needed in order to properly disperse milk protein powder into water or milk. A commonly used in-line mixer in the dairy industry is a Tri-Blender®. A Tri-Blender® works well to disperse protein-containing powders into liquids. They have a high-speed, high-shear mixing chamber and do a good job of evenly dispersing powder into liquids, water or milk, without lumps. If the RTD factory does not have a Tri-Blender® available, a Likwifier type of mixer will also function well to mix milk protein powder into fluids. The goal when mixing milk protein powder into liquids is to produce a dispersion where the powder is evenly distributed throughout the liquid. High-speed, high-shear mixers work best for protein powder dispersion into liquids, although a fast action agitator that works up strong turbulence in the liquid may be sufficient to thoroughly disperse milk protein powder into water or milk.

One should always start with the water or milk in the mix tank and start the agitators before beginning to add the milk protein powder to the liquid. The water or milk should be at optimal temperature when the powder is added to the liquid in the mix tank. If one tries to mix milk protein powder into hot water, some “plasticizing” of the milk protein powder could occur which would decrease the solubility of the protein powder in the resulting RTD beverage.

Failure to disperse the MPC/MPI powder into a homogenous dispersion will result in the formation of MPC/MPI lumps in the milk. Once these lumps form, they are extremely difficult, if not impossible, to break up. The lumps will contain dry MPC/MPI powder in the center. If lumps do form in the milk because of poor dispersion actions, the end result will be:

- At the very least, the lumps will potentially clog the RTD factory’s in-line filters.
- The RTD would then contain a lower protein level per serving than desired.
- If smaller lumps make it past the factory’s in-line filters, they might clog the filling line nozzles or precipitate out to the bottom of the RTD package upon shipping and storage.
- The balance of milk protein to phosphate stabilizing salts will be off from the desired ratios and this could negatively affect the RTD shelf life.
- Lumps in the finished RTD would be a definite negative for consumers.

Hydration of MPC/MPI in Water or Milk When Manufacturing RTD’s:

A common mistake made by RTD manufacturers who use milk protein powders as the protein source is that they do not allow sufficient time after mixing the powder into water or milk for the powder to hydrate. Proper hydration in this instance refers to allowing time for water to penetrate the spray dried protein particles and soften the inner and outer surface of the particles so that they dissolve when further exposed to heat.

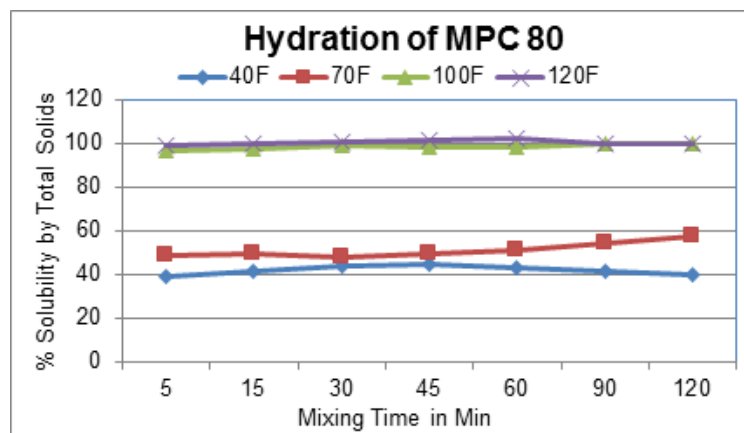
Many RTD factories mix the protein powder with water or milk and immediately start adding all of the other ingredients (fat source, carbohydrate, flavoring, etc.). Many of these added ingredients will compete with the protein for water and impede hydration of the protein powder. The first ingredients added after the holding time should be the phosphate stabilizing salts dissolved in a small amount of water. They will help to soften the protein powder particle surfaces even more and accelerate hydration. After that, the other ingredients may be added to the mix tank. Proper hydration will help ensure the RTD beverage has the smoothest possible mouthfeel and will also help to extend shelf life of the RTD.

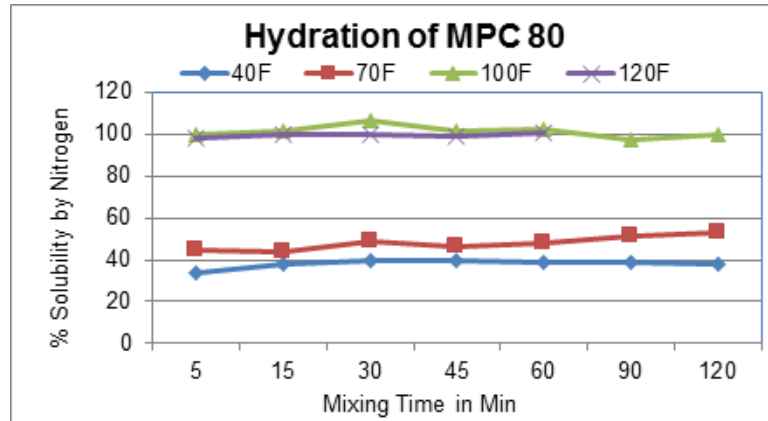
Failure to properly hydrate the MPC/MPI powder in the milk may result in the following:

- Instability of the RTD beverage. The RTD beverage may gel or demonstrate phase separations within one or two weeks if the powder did not hydrate well.
- A decreased shelf life for the beverage. The decrease could be minor in some cases but significant at other times.
- Inconsistent RTD shelf life. With proper hydration techniques, the RTD should display a consistent shelf life from batch to batch using the same formula and processing conditions every time.
- The RTD could take on “powdery” flavor notes.
- “Burn on” in the UHT pasteurizing tubes will increase. Increased “burn on” could lead to shorter processing line run times between required clean ups.

Maximizing MPC/MPI Solubility:

Once the factory has properly dispersed the milk protein powder into water or milk by making use of high-speed, high-shear mixers and has allowed sufficient time for the powder to hydrate, obtaining maximum protein solubility should not be a problem. Solubility is a function of time and energy in the system. At higher temperatures, solvation, the process by which solvent molecules surround and interact with solute ions or molecules, occurs faster. At lower temperatures, solvation proceeds more slowly. It is essential to select the right temperature and mixing time for proper dispersion and hydration of protein powder into water.





At standard HTST pasteurization temperatures, a well dispersed and well hydrated milk protein dispersion should reach maximum solubility within 5 minutes. At UHT pasteurization temperatures, the protein powder will reach maximum solubility almost instantaneously. Therefore, by the time the RTD mix has been pasteurized and sent to the filling line, the powder should be solubilized to the maximum possible.

Failure to ensure maximum solubility of the powder in an RTD may result in:

- Grainy mouthfeel.
- Protein may precipitate to the bottom of the RTD container or the undissolved protein may float to the top of the RTD and be evident when the package is opened.
- Shortened shelf life.
- Inconsistent shelf life length.

Maximizing MPC/MPI solubility through proper RTD processing techniques will ensure the consistent RTD quality and shelf life.

Idaho Milk Products is happy to help in selecting the optimal dispersion and hydration conditions and support your formulation or finished product processing questions. Feel free to visit the FAQ section of our website at <http://idahomilkproducts.com/faq>, or call your sales manager who can refer you to the appropriate application expert.

