Milk Protein Concentrate Ingredients

Milk protein concentrate (MPC) is produced from skim milk by a series of processes that includes ultrafiltration (UF), evaporation and drying. MPC contains undenatured forms of both casein and whey protein. The level of protein, lactose and mineral present varies depending on the degree of protein concentration. Ultrafiltration determines the composition of the MPC while evaporation and drying are used to remove only water. The product also is pasteurized to eliminate potential pathogens in raw milk.

UF is a sieving process that separates milk components according to their size. During this process, milk passes across a membrane. Some of the lactose, minerals and water will cross through the membrane and become the permeate stream. Casein and whey proteins, because of their larger size, will not be able to pass through the membrane. The proteins along with the lactose and minerals that did not go into the permeate stream will become the retentate stream. A diafiltration or washing step is required to get protein concentration greater than 65% in the final dried product. Diafiltration involves adding water to the retentate as it is being ultrafiltered to reduce product viscosity and further remove lactose and minerals.

Following UF, the retentate may be evaporated to increase the total solids in the processing stream, which improves dryer performance. The retentate then is spray dried.

Currently, there is no standard of identity for MPC in the U.S. Although UF is the preferred method for extracting MPC, it also can be produced by precipitating the proteins out of milk or by dry blending the milk proteins with other milk components. Depending on how MPC is produced, costs may vary and, more important, functionality may differ.

Commercially, MPCs are available in a range of protein levels, from 42% to 85%. Typical MPCs offered are MPC42, MPC70, MPC75, MPC80 and MPC85. As the protein content of MPCs increases, the lactose levels decrease. For example, MPC42 is 42% protein and 46% lactose. MPC80 contains 80% protein and 4.1% lactose. For comparison, skim milk powder (SMP) contains about 35% protein and 52% lactose.

MPCs are white to light-cream-colored dry powders. They are best used within one year of receipt. Recommended storage is below 25°C and 65% relative humidity in a cool, odor-free, dry environment. If the product has been opened and resealed, it should be used within one month of opening.

Typical Composition of Milk Protein Concentrate (%)

Ingredient	Moisture	Fat	Protein	Lactose	Ash
MPC42	3.5	1.0	42.0	46.0	7.5
MPC70	4.2	1.4	70.0	16.2	8.2
MPC75	5.0	1.5	75.0	10.9	7.6
MPC80	3.9	1.8	80.0	4.1	7.4
MPC85	4.9	1.6	85.0	1.0	7.1

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Beneficial Features

MPC is used for its nutritional and functional properties. It is high in protein content (casein and whey protein) and contributes approximately 360 kcal/100g. Higher protein-containing MPCs can be low in carbohydrate content, containing minimal amounts of lactose. This high-protein, low-lactose ratio makes MPC an excellent ingredient for protein-fortified beverages and foods and low-carbohydrate foods. MPCs also retain a fair portion of calcium because it is bound to the casein.

Functionality

Many desirable properties are attained by the addition of MPC to food formulations. It is used as an ingredient in the kinds of applications that often rely on SMP, but require a higher level of protein. Common applications include infant formulas, desserts, baked goods, toppings, lowfat spreads, dairy-based dry mixes, dairy-based beverages, sports and nutrition beverages and foods, geriatric nutritional products, weight-loss beverages and foods, and some processed cheese products and foods. MPC is not allowed as an ingredient in cheese with a federal standard of identity (e.g., Cheddar).

Foaming/Whipping—The proteins in MPC act at the air/water interface to form a stable film of air bubbles. This stabilizes meringues, mousses, cakes, ice creams, whipped cream and soufflés.

Emulsification—The proteins in MPC act at the oil/water interface to form and stabilize fat emulsions in sausages and other processed meats, dairy drinks, soups, vinaigrettes, sauces and bakery products.

Solubility—UF preserves the original protein structure of MPCs, which results in a greater solubility. Because they are readily soluble, MPCs are beneficial in dry dairy-based mixes.

Water Binding/Viscosity—The interior protein structure of MPCs traps water, increasing the viscosity of a food product. This is applicable for cheeses, firm yogurts, sauces, milk-based drinks and creams for desserts and bakery products.

Browning/Coloring/Flavoring—The lactose and proteins in MPC can undergo Maillard browning, resulting in an appealing color for bakery products such as pastries, cakes and muffins.

Flavor—The bland flavor of MPCs allows other flavors in a food to fully develop.

To learn more about MPCs or for help in formulations, contact the Technical Support Hotline, 1-800-248-8829.

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