Dairy Ingredients Functionality and Composition Reference Guide

Think USA Dairy
brought to you by U.S. Dairy Export Council

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The Dairy Ingredients Functionality and Composition Reference Guide features compositional analysis for U.S. milk and whey ingredients as well as functional information for these ingredients when used in food applications. The information can be easily used to select the best milk-derived ingredients for a wide range of food applications.

Dairy Ingredient Functionality in Food Applications

Legend: + low ++ medium +++ high = not applicable or not appropriate/recommended

	WHEY PROTEINS							MILK PROTEINS						CASEINS	COPRODUCTS	
	Sweet Whey Powder	Acid Whey Powder	Demineralized Whey	WPC 34	WPC 80	WPI	WPPC	WMP, DWM	SMP, NDM	MPC 56	MPC 70	MPC 80	MPI	Micellar Casein	Milk & Whey Permeate	Lactose (food grade)
BAKERY																
Browning/color	+++	+++	+++	++	+	+	+	++	++	++	+	+	+	+	+++	+++
Emulsification	+	+	+	++	+++	+++	+++	+	+	++	++	++	++	++	+	+
Flavor/Aroma	+++	+++	+++	++	+	+	++	+++	++	++	+	+	+	+	+++	+++
Foaming/Whipping	++	++	++	++	++	+++	++	+	+	+	+	+	++	+	+	+
Nutritional/Protein enrichment	+	+	+	++	+++	+++	++	++	++	++	+++	+++	+++	+++		
Water binding	+	+	+	+	++	++	++	++	++	++	+++	+++	+++	+++	+	+
BEVERAGES																
DAIRY PROTEIN, CLEAR (PH 2.8-3.4)																
Acid stability						+++										
Heat stability						++										
Nutritional/Protein enrichment						+++										
DAIRY PROTEIN, OPAQUE (PH 2.8-3.4)																
Acid stability	+++	+++	+++	+++	+++	+++	+++									
Heat stability	+++	+++	+++	+++	+++	+++	+									
Nutritional/Protein enrichment	+	+	+	++	+++	+++	++									
YOGURT DRINKS/SMOOTHIES (PH 3.5-4.5)																
Acid stability	+++	+++	+++	+++	+++	+++	+++	+	+	+	+	+	+	+	+++	+++
Emulsification	+	+	+	++	++	++	++	++	++	+++	+++	+++	+++	+++		
Heat stability	+	+	++	++	++	++	++	+++	+++	+++	+++	+++	+++	+++	++	++
Nutritional/Protein enrichment	+	+	+	++	+++	+++	++	++	++	++	+++	+++	+++	+++		
Viscosity/Water binding	+	+	+	+	++	++	++	++	++	++	+++	+++	+++	+++	+	+

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	WHEY PROTEINS							MILK PROTEINS							CASEINS	COPRODUCTS	
	Sweet Whey Powder	Acid Whey Powder	Demineralized Whey	WPC 34	WPC 80	WPI	WPPC	WMP, DWM	SMP, NDM	MPC 56	MPC 70	MPC 80	MPI	Micellar Casein	Milk & Whey Permeate	Lactose (food grade)
SHAKES, MEAL REPLACEMENTS, RECOMBINED DAIRY/MILK BEVERAGES (PH 6.8-7.0)																
Emulsification	+	+	+	++	++	++	++	++	++	+++	+++	+++	+++	+++		
Heat stability	+	+	+	+	+	+	+	+++	+++	+++	+++	+++	+++	+++	++	++
Nutritional/Protein enrichment	+	+	+	++	+++	+++	++	++	++	++	+++	+++	+++	+++		
Viscosity	+	+	+	+	+	+	+	+	+	++	++	++	++	+++	+	+
OTHER BEVERAGES (NO PROTEIN)																
Acid stability															+	+
Heat stability															+	+
Solubility															++	++
CONFECTIONERY																
CHOCOLATE																
Emulsification	+		+	++	++	+++	++	++	++	++	++	+	+	+		
Flavor (dairy note)	++		+++	++	+	+	++	+++	+++	+++	++	+	+	+	+++	+++
Nutritional/Protein enrichment	+		+	++	+++	+++	++	++	++	++	+++	+++	+++	+++		
Whipping	+		+	++	++	+++	++	++	++	++	++	+	+	+		
OTHER CONFECTIONERY (CARAMEL, WHITE COATINGS, MARSHMALLOW, GUMMIES)																
Browning	+++	+++	+++	++	+	+	++	++	++	++	+	+	+	+	+++	+++
Emulsification	+	+	+	++	++	++	+++	++	++	+++	+++	+++	+++	+++		
Flavor (dairy note)	++		+++	++	+	+	++	+++	+++	+++	++	+	+	+	+++	+++
Heat gelation	+	+	+	++	+++	+++	+++									
Heat stability	+	+	++	+	+	+	+	+++	+++	+++	+++	+++	+++	+++	++	++
Nutritional/Protein enrichment	+	+	+	++	+++	+++	++	++	++	++	+++	+++	+++	+++		
Viscosity/Water binding	+	+	+	+	++	++	++	++	++	++	+++	+++	+++	+++	+	+
Whipping	++	++	++	++	++	+++	++	+	+	+	+	+	++	+		
YOGURT																
Gelation	++	++	+	+++	+++	+++	+++	++	++	++	+++	+++	+++	+++		
Nutritional/Protein enrichment	+	+	+	++	+++	+++	++	++	++	++	+++	+++	+++	+++		
Viscosity	+	+	+	+	++	++	++	++	++	++	+++	+++	+++	+++	+	+
Water binding	+	+	+	+	++	++	++	++	++	++	+++	+++	+++	+++		

Compositional Guide for Milk and Whey Ingredients

	WHEY PROTEINS							MILK PROTEINS						CASEINS	COPRODUCTS	
	Sweet Whey Powder	Acid Whey Powder	Demineralized Whey	WPC 34	WPC 80	WPI	WPPC	WMP, DWM	SMP, NDM	MPC 56	MPC 70	MPC 80	MPI	Micellar Casein	Milk & Whey Permeate	Lactose (food grade)
Protein[1] (%)	11.0-14.5	11.0-13.5	11.0-15.0	34.0-36.0	80.0-82.0[2]	90.0-92.0[2]	min 50.0	24.5-27.0	34.0-37.0	55.5 min	69.5 min	79.5 min	89.5[2] min	83.0	2.0-7.0[3]	0.1
Lactose (%)	63.0-75.0	61.0-70.0	70.0-80.0	48.0-52.0	4.0-8.0	0.5-1.0	1.0-11	36.0-38.5	49.5-55.0	36.0 max	20.0 max	9.0 max	5.0 max	1.0	76.0-88.0	min 99.0[4,5]
Fat (%)	1.0-1.5	0.5-1.5	0.5-1.8	3.0-4.5	4.0-8.0	0.5-1.0	min 12.0	26.6-40.0	0.6-1.25	1.5 max	2.5 max	2.5 max	2.5 max	1.0	0-1.5	0
Ash (%)	8.2-8.8	9.8-12.3	1.0-7.0[6]	6.5-8.0	3.0-4.0	2.0-3.0	max 8.0	5.5-6.5	8.2-8.6	10.0 max	10.0 max	8.0 max	8.0 max	7.8	8.0-14.0	0.1-0.3
Moisture (%)	3.5-5.0	3.5-5.0	3.0-4.0	3.0-4.5	3.5-4.5	4.0-6.0	max 6.0	2.0-4.5	3.0-5.0	5.0 max	6.0 max	6.0 max	6.0 max	5.0	3.0-5.0	4.5-5.5[4]
pH	5.7-6.0	4.4-4.6	6.2-7.0	6.0-6.7	6.0-6.7	6.0-6.7	5.7-7.5	6.0-6.8	6.5-6.8	7.0-7.2	7.0-7.2	6.6-6.8	6.5-7.0	6.6-7.2	5.5-6.6	4.5-7.0

ABBREVIATIONS:
WPC: Whey Protein Concentrate
WPI: Whey Protein Isolate
WPPC: Whey Protein Phospholipid Concentrate. This product is also commonly referd to as 'whey cream' or 'High Fat Whey Protein Concentrate'
WMP: Whole Milk Powder. WMP refers to the product that meets the Codex Alimentarius regulations which allows protein level adjustment to a mininum of 34% of the milk solids not fat.
DWM: Dry Whole Milk. DWM refers to the product that meets the U.S. Code of Federal Regulations.
SMP: Skimmed Milk Powder. SMP refers to the product that meets the Codex Alimentarius regulations which allows protein level adjustment to a mininum of 34% of the milk solids-not-fat.
NDM: Nonfat Dry Milk. NDM refers to the product that meets the U.S. Code of Federal Regulations.
MPC: Milk Protein Concentrate
MPI: Milk Protein Isolate

TABLE FOOTNOTES:
[1] Protein content is reported "as is" unless indicated (It is industry practice to report the protein content of high-protein ingredients e.g., protein ≥80%, on a "dry basis")
[2] Protein is expressed on a "dry basis"
[3] Non-protein nitrogen compounds (non-functional protein)
[4] Includes bound water
[5] Includes monohydrate or anhydrous
[6] Ash content varies from 1% to 5% depending on the level of demineralization: approx. 1% ash for 90% demin. whey and approx. 5% ash for 25% demin. whey

Compositional guide information adapted from various Supplier Product Specifications; USDEC Reference Manual for U.S. Whey and Lactose Products, 2004; ADPI Whey Protein Phospholipid Concentrate Standard; USDEC Reference Manual for U.S. Milk Powders, 2005 Revised Edition; ADPI Concentrated Milk Proteins Standard; USDEC Micellar Casein Concentrate Spec Sheet, 2015; ADPI Dairy Permeate Standard (Note: slight specification differences between milk and whey permeate).

For more information, visit ThinkUSAdairy.org.

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