Table 5.5 Shelf life and primary cause of deterioration of milk ingredients.

Product	Typical shelf life[a]	Primary cause of failure
Anhydrous milk fat	12 months in drums at 15–20°C (59–68°F)	Oxidation
Skim milk powder	24 months plus at 25°C (77°F), standard atmosphere	Development of aged flavours
Whole milk powder	24 months at 25°C (77°F) under nitrogen, dry storage	Oxidation, development of aged flavours
High-fat powders	9 months at 25°C (77°F) under nitrogen, dry storage	Oxidation
Buttermilk powder	24 months at 25°C (77°F) under nitrogen, dry storage	Oxidation
Formulated milk powder	24 months at 25°C (77°F) under nitrogen	Oxidation
Whey powder	24 months	Caking, aged flavours
Milk crumb	24 months	Development of aged flavours
Lactose	24 months	Caking

[a] Assumes storage at relative humidity below 65% and in an odour-free environment.

Table 5.6 Typical profile for powder products used in chocolate manufacture.

Property type	Measured property	Typical specification		
		SMP	WMP	BMP
Chemical	Titratable acidity (%)	<0.15	<0.15	<0.15
	Free fat (% powder)	[a]	2.5	[a]
	WPNI (mg/g)	1–6	1.6	[a]
Physical	Insolubility index (mL)	<1.0	<1.0	<1.0
	Bulk density (g/mL)	0.70	0.60	0.65
Microbiological	Aerobic plate count ($\times 10^4$/g)	<2	<2	<2
	Coliforms (per g)	Absent	Absent	Absent
	E. coli (per g)	Absent	Absent	Absent
	Yeasts and moulds (per g)	<50	<50	<50
	Salmonella (per g)	Absent	Absent	Absent
	Coagulase-positive *Staphylococci*	Absent	Absent	Absent

[a] Typically not specified.
Milk powders will also have specifications for flavour, odour and foreign matter.

treatment to which a powder was subjected prior to spray drying. Powders with high titratable acidity levels are an indication of poor raw milk handling procedures prior to powder manufacture. High titratable acidities are often found in products with significant off-flavours.

Spray drying, roller drying and crumb processing are used to produce a variety of milk powders for use in chocolate manufacturing. Milk powder in its

simplest form involves solids concentration of fluid milk by evaporation followed by drying and packaging. However, the functional properties of milk powders in chocolate are very dependent upon the specific raw materials, pre-treatment and drying conditions used to make the powder. Milk powders for chocolate applications require different properties than those needed for recombined milk applications and, therefore, manufacturers producing powers for the chocolate industry must understand these differences in order to produce powders that are optimised for chocolate. This may require special installations and manufacturing steps to the standard spray dryers or utilising the higher energy requiring roller drying technique; however, the economic benefits of using spray drying have led to a reducing availability of roller dried powder globally (Aguilar and Ziegler, 1993).

5.3.2.1 Milk powder properties important for chocolate manufacturing

During chocolate processing and in the final chocolate, flow properties, tempering conditions, hardness, sensory impact, storage stability and retention of bloom development are parameters affected by the chosen type of milk powder. Although milk powders may have the same chemical composition, the powder characteristics that influence chocolate are the degree of free fat, particle size, structure, occluded air and bulk density. Table 5.7 shows the characteristics for standard spray and roller dried whole milk powder, compared with crumb powder.

The effect of using different milk powders on chocolate viscosity is shown in Figure 5.6; the powders used were standard spray-dried whole milk powder with low free fat (LSW) and high free fat (HFW), roller dried whole milk powder (RDW) and spray-dried skim milk powder (LSN) with anhydrous butter fat (AMF).

Table 5.7 A comparison of standard milk powder and roller dried milk powder, compared with crumb powder.

Properties	Spray Whole Milk powder	Roller Whole Milk powder	Crumb
Drying temperature in product	<80 °C	>100 °C	70–100 °C
Drying time	From atomizer to fluid bed 2 sec (Hot zone) Agglomeration within 12 sec	2–5 sec	3–8 hours
Particle shape	Globular	Flakes	Network of small crystal
Particle surface	Smooth porous	Rough	Smooth
Occluded air	Varies	Low	Low
Free Fat content	1–10%	80–85%	80–98%
Lactose	Amorphous	Slight crystallized	Crystallised
Moisture	3%	3%	<2%