Skim Milk Powder (SMP)

Skim milk powder (SMP) has low moisture and fat contents and, when stored in dry, cool conditions, has a shelf life in excess of two years. Specifically, when stored at 15°C and a relative humidity of 75%, skim milk powder has a minimum shelf life of two years, an average shelf life of three years and a maximum shelf life of four years. Milk powders are hygroscopic: they tend to attract water readily from humid atmospheres. When moisture levels are excessive, milk powders may become sticky, caked or lumpy, and exhibit reduced flow ability and solubility. These changes affect the ease of use of the product, requiring grinding for example and may affect the flavor, but do not represent a health or safety problem. **If the powder's moisture content exceeds 15%, it then becomes susceptible to microbiological growth and should not be used.**

Typical Composition

Particulars	Specifications
Protein	34.0% - 37.0%
Lactose	49.5% - 52.0%
Fat	0.6% - 1.25%
Ash	8.2% - 8.6%
Moisture	3.0% - 4.0% (non-instant) 3.5% - 4.5% (instant)

Source: USDA

Physical and Chemical Characteristics

Typical Microbiological Parameters	
Standard plate count	< 10,000 cfu/g*
Coliform	≤ 10/g (maximum)
E.coli	Negative
Salmonella	Negative
Listeria	Negative
Coagulase-positive staphylococci	Negative
Other Characteristics:	
Scorched particle content	7.5 - 15.0mg (spray-dried)
	22.5mg (roller-dried)
Titratable acidity	0.14 - 0.15%
Solubility index	1.0 ml (instant)
	1.2 ml (spray-dried, low-heat)
	2.0 ml (spray-dried, high-heat)
	15.0 ml (roller-dried)
Color	White to light cream color
Flavor	Clean, pleasing dairy flavor

Source: USDA

Skim milk powder should have a mild flavor and aroma. After extended storage, some milk powder may develop slight off-flavors. These may be noticed in rehydrated or "recombined" milk products. However, milk powders for use as ingredients in manufactured foods and dry blends generally do not need to meet as high standards of palatability and redispersibility.

Influence of storage on chemical and physical properties of skim milk powders

Which flavor changes can be expected?

- The flavor and odor of milk powder should be sweet and clean, entirely free from rancid or other objectionable odors.
- Off-flavors developing in dried milk products during storage may be due to many different compositional, processing or other variables.
- The occurrence of off-flavors may also be an indication of spoilage, microbial growth, or contamination. Bags of milk powders should be stored in a dry, clean area. Contact with spoiled foods, wet cardboard, wood or any other material that may be moldy or has the potential to support mold growth should be avoided.
- At high storage temperatures, these types of flavors have been described in dried milk products. A slight caramelized taste is objectionable in products such as yogurts, ice cream and similar products.

Is solubility affected by extended storage?

- Extended storage of dried milk products may result in decreased solubility of proteins. The insolubility is generally attributed to the Maillard reaction, which involves reducing sugars and proteins.
- Storage studies of dried milk products have shown that the products stored in a variety of conditions could exhibit slight changes of solubility.
- The changes are not commercially important, yet it remains preferable to store milk powders at temperatures well below 40°C for a maximum retention of solubility characteristics over a long period of time.
- The term solubility is also used to describe the dispersing characteristics of milk powders when reconstituted with water or other fluids. Tests to determine the "solubility" of milk powders depend upon a number of factors such as the amount of dissolved minerals, "hardness", in the water used, speed and duration of stirring and temperature, and other factors. The use of mechanical agitation and mild heat in sanitary conditions may be required to facilitate "wetting" and dispersion of some milk powders. For uses

where the powder is blended with other dry ingredients as, for example, in baked goods, the degree of solubility of milk powder is not very critical.

What is the impact of browning on functionality of milk powders?

- A powder that has developed extensive browning or appears to have deteriorated should not be used. Slight browning may be associated with flavor changes, making the powder less desirable in applications such as yogurt, ice cream and other dairy products.
- These changes, however, are not noticeable in bakery applications. Some studies have shown, in fact, that volume of baked goods can increase with the length of storage and degree of browning of dried milk ingredients. Typically, the level of protein denaturation achieving during the processing of milk powders is a more significant indicator of performance for industrial bakers than small changes occurring during storage.

What is the impact of storage on the powder's acidity? (i.e. pH level)

- In some studies, the pH of milk powders stored at room temperature was shown to decrease. The pH change can also be attributed to the bonding of amino groups by lactose in the Maillard reaction. Changes in pH do not appear to be significant for a milk powder user at the commercial level.
- A milk powder that has deteriorated extensively as a result of poor storage conditions, and that appears to have an unpleasant, acidic taste, should not be used.

What is the impact of storage of flow properties?

- Skim milk powder is hygroscopic (attracts moisture) because of its high lactose content. If exposed to the atmosphere it can absorb sufficient moisture to induce caking or the development of lumps, resulting in a powder that flows poorly or not at all.
- Proper storage conditions and good packaging can reduce stickiness, caking, and lumpy problems.

Recommended Uses of a Function of Heat Treatment

Classification	Typical Processing Treatment	Un-denatured Whey Protein Nitrogen* (mg/g)	Recommended Applications
Low-heat	Cumulative heat treatment of milk not more than 70ºC for 2 minutes	≥ 6.00	Fluid milk fortification, cottage cheese, cultured skim milk, starter culture, chocolate dairy drinks, ice cream
Medium-heat	Cumulative heat treatment of 70 -78ºC for 20 minutes	1.51 - 5.99	Prepared mixes, ice cream, confectionery, meat products
High-heat	Cumulative heat treatment of 88ºC for 30 minutes	≤ 1.50	Bakery, meat products, ice cream, prepared mixes

Source: USDA

Influence of storage on the nutritive of skim milk powders

Lysine and the sulfur-containing amino acids are principal among those that suffer some slight destruction during the high temperature treatments of milks or Maillard reaction. Protein quality losses can occur during normal storage. Studies have shown that methionine and tryptophan content do not change significantly during storage at temperatures ranging from –40 to 40°C and water activities in the 0.15 to 0.41 range.

The available lysine decreases most at high water activity and at the highest temperature. However, losses of lysine after 6 months of storage at 20°C (at any water activity level) are less than 8% (typically less than 6%.) It is only during extended storage (over 6 months) at temperatures exceeding 40°C and at high water activity that the loss of lysine, and therefore the change of nutritional quality of milk proteins, becomes more significant (with losses of 15-24%). Such extreme conditions are rarely encountered in commercial situations.

Is the biological value of milk protein reduced during storage?

The biological value of milk proteins is not significantly altered during the manufacture of milk powders or during storage in good conditions for an extensive period of time. Maintaining the nutritional value of milk proteins during storage is not a problem, provided the temperature is kept below 40°C and water activity (humidity) low.

Is vitamin content affected by storage in milk powders?

The amounts of thiamin (B1), riboflavin (B2), niacin, calcium pantothenate, biotin, and pyridoxine present in dried milk are quite comparable to those of market milk and are not affected by storage for 6 months at 35°C. Vitamin C content is slightly reduced during storage for 6 months.

Expected shelf-life

What is the expected shelf life of milk powder that has been transported or stored for three months at temperatures above 35°C?

Storage at high temperatures can reduce shelf-life because some reactions, such as non-enzymatic browning, are temperature-dependent. It is the combination of heat and high humidity that will significantly reduce shelf-life. For example, studies have shown that storage for 3 months at 37°C and 90 percent relative humidity is equivalent to storage for 12 months at ambient temperature in temperate climates (approx. 15-25°C, 80% RH or less). Therefore, the remaining shelf-life may be reduced by a factor of 4 if the powder is stored in high heat/ high moisture conditions.

Increases in the moisture content of the milk powder will cause browning and caking first, and while SMP will be safe, it will be harder to use. Further increases in the moisture content of SMP (above 15%) may allow bacterial growth and the SMP should not be used.

If the uptake of moisture is due to packaging failure or punctures, or if it appears that the product has been tampered with in any fashion, the milk powder should not be used.

Storage and safety issues

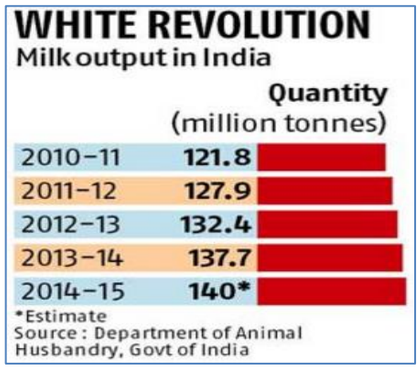
Milk powder made from good quality milk and containing low microbial counts is microbiologically safe during storage, provided the moisture content is kept low during storage. Bacteria, yeast and mold will not grow in milk powder that has been stored in good conditions. Powder that has been exposed to water or excessive humidity during storage (so its moisture content is above 15%) can sustain microbiological growth and should not be used.

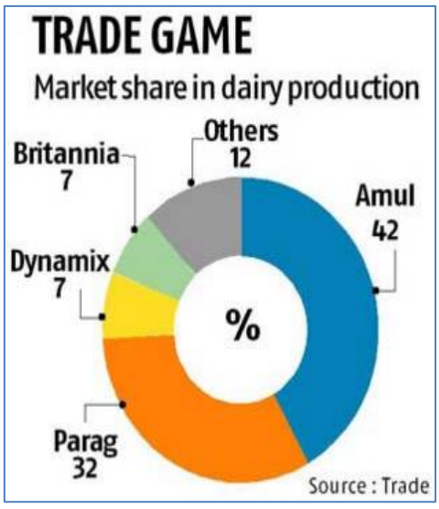
Testing quality

Milk powders should be evaluated organoleptically, chemical-physically, and microbiologically to fully determine the quality and condition. However, an organoleptic evaluation test is the only test that can be performed with minimum equipment. The organoleptic evaluation of reconstituted skim milk powder should have a taste and smell close to that of milk. A slight cooked flavor and smell is acceptable.

Skim milk powder (SMP) – Trade Outlook for India & World

India's total milk production is estimated at 140 million MT in 2014-15, a rise of three million tonnes from the last year. But, over the past six years, milk production has increased by six million tonnes. According to an estimate, only five per cent of the overall milk production in India goes to dairies in commodity business. Of the total milk production in India, organized sector contributes only 20 per cent and about 80 per cent still comes from the unorganized sector. This small segment of the dairy industry plays a spoilsport and has pushed the entire industry into doldrums.



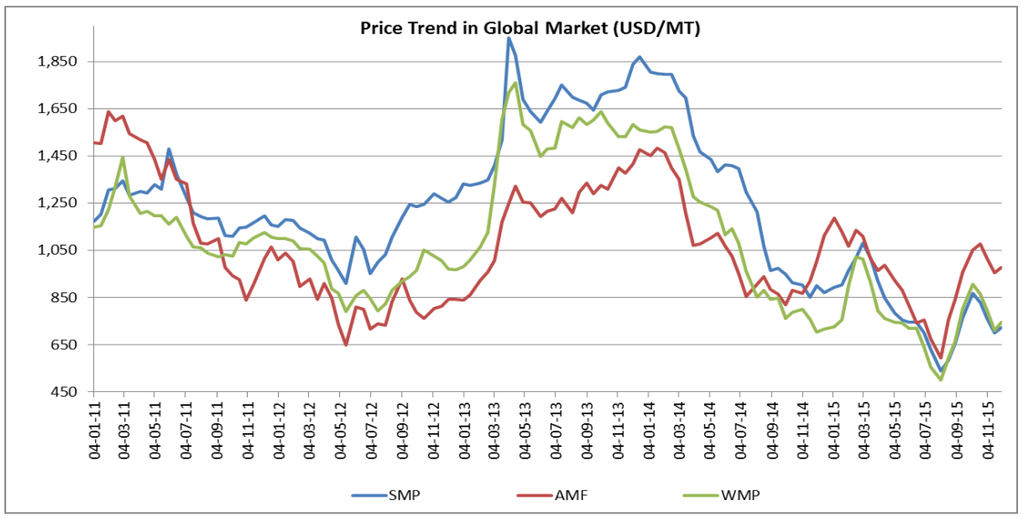


India's milk farmers are hit by a sharp decline in realization from dairy farms in the past year. So, farmers are abstaining from fresh investment which could affect milk availability in the peak demand season beginning March. Because of a sharp fall in milk prices, dairy producers are fetching huge margins as the same has not been passed on either to daily milk consumers or processed food (cheese, curd, butter milk, etc) buyers. Moreover, falling milk prices have created pressure on organized dairy producers to cut prices, which they are likely to do in January. Dairy products' prices have declined by 50 per cent in the past one year. In areas where farmers are supplying milk to dairy producers especially for products (skimmed milk powder or SMP), producers have been realising at least 30-40 per cent lower this year. Because of oversupply, dairy companies have not raised milk prices in the past one year despite a 20-30 per cent increase in animal feed prices.

India has hardly exported any SMP consignments this year owing to low prices in the global market, which, in turn, has also kept the domestic liquid milk prices in check.

The development in the world market is also causing added bearishness in the SMP and other daily product market. As per recent reports, the global dairy sector is in turmoil with the price of production outstripping farm gate prices in many countries, a glut of milk on the market and stagnation in traditional and expanding export markets. The top-five milk producing countries Germany, France, UK, Netherlands and Italy saw an average June price of €31.20/100kg which was a €0.51/100kg or 1.6 per cent down on the previous month and over 15 per cent down from previous year.

Global Dairy Trade auction at the beginning of August showed a fall in the overall GDT Price Index of 9.3 per cent and the falls in prices were seen across the products. The biggest fall in the Price Index was for Skimmed Milk Powder (SMP), which dropped by 14.4 per cent to $1,419 per MT. Anhydrous Milk Fat (AMF) and Whole Milk Powder (WMP) saw the index fall by 11.7 per cent and 10.3 per cent respectively to $2,253 and $1,590 per MT. The main reason for the decline in price is the supply glut of milk on the market can be attributed to several causes. In the EU, the end of the quota system has helped to boost production, as farmers across the EU geared up to sell on the open market. Germany, for example, had a quota for the final year of the system of 30.225 million tonnes. It actually delivered 31.335 million tonnes.



However, one of the major export markets, Russia, put up the shutters on EU dairy products, among others, in the autumn of 2014 as part of the retaliatory action over sanctions because of Russia's stance over the crisis in Ukraine. Russia was the destination of 13 per cent of the EU exports in milk equivalent, with the share much higher for cheese and butter at 32 per cent and 24 per cent respectively. In the year before the ban, Russia imported 57,000 MT of butter. The year following the ban saw that figure fall 7.8 times to just 7,300 MT. SMP fell from 45,000 MT to 7,100 MT and WMP fell from 8,500 MT to 2,400 MT. The largest drop came in cheese, which went down from 385,000 MT to just 41,000 MT.

In the absence of Russian market, EU looked at China for demand support. But, the Chinese market suddenly dried up, as the country found it had reached saturation point with imported product and had more than it could cope with. New Zealand was the major sufferer by this development. The country that exports two thirds of its whole milk powder had China As its biggest customer. Shipments in the first five months of 2015 fell by 65 per cent and consequently brought prices down to their lowest since 2009.

While export markets have been drying up and farm gate prices tumbling around the world, farmers in some countries have also been hit by volatile currency exchange rate. The high exchange rates have made exports even more expensive and markets more difficult.

Trend View

Overall the Dairy industry in World as well as in India will continue to feel the pressure of glut in supply. Recently, in case of India the current SMP inventory is at 70,000-80,000 MT with negligible exports on account of low global prices. In 2013-14, however, Indian companies exported about 125 lakh tonnes when global prices were between $4,000 and $4,800/MT but at the current price levels of below $1500/MT the exports have turned unviable.