



Cavitation Technology for Dairy Powder Processing

A NEXT GENERATION MICROSCOPIC MIXING AND SCALE FREE HEATING TECHNOLOGY

The latest hydrodynamic cavitation technology enables enhanced efficiency in processing of nutritional dairy powders. The APV Caviator™ ensures highly efficient scale-free heating, spray drying, powder hydration and functionalization and effective emulsification and gas dispersion

With the rising global demand for high quality milk and whey based powder ingredients for a wide range of applications across dairy, food and beverage industries nutritional dairy powder are a quickly growing segment.

Market trends are being driven by many factors including a growing youth population, increased spending power in emerging markets, and the dairy nutrition cross over into the high-growth nutritional beverage market.

There is an increasing demand from consumers for more nutritional products that are natural, functional, healthy, tasty and convenient products which is leading to expanding application requirements. Combined with highly competitive market places and environmental pressures, new and innovative processing technologies are needed.

SPX Technology for Nutritional Dairy Powder Processing

SPX is a leading provider of innovative process equipment for the production of infant formulas, milk derivative powder from SMP and WMP to more advanced MPC categories. Furthermore, we are also involved in supplying equipment for the processing of whey derivative powder from whey powders to high grade WPC or WPI and permeate powder and various grades of lactose. Our food technologists are constantly focussing on new ways to support customers with the modern challenges they are facing. SPX's solution portfolio includes all process line equipment from milk and whey intake through liquid membrane and thermal processing to evaporation and drying, and may also include partnerships with powder handling providers. Supported by leading Innovation Centres, SPX has proven ability in helping customers develop and produce a wide range of high quality and safe nutritional dairy concentrates and powder products.



Hydrodynamic Cavitation Technology

Hydrodynamic cavitation technology uses a rotor with precisely machined cavities spinning in a liquid chamber that generates controlled cavitation. The process generates and collapses bubbles due to the decrease and then increase in pressure produced. As the bubbles collapse, a very powerful energy wave (shockwave) is released into the surrounding liquid. This cavitation shockwave creates a very efficient, microscopic mixing effect and the rotor / liquid friction generates controllable, scale-free heating. The APV Caviator™, shown in Figure 1, has multiple applications (Table 1) including pre-treatment and structural conditioning of milk and whey to enhance process efficiency, powder hydration and functionalization, scale free heating, emulsification and gas dispersion. The applications are represented in Table 1 and two of these applications will be further reviewed here.

Viscosity reduction & structural conditioning

Viscosity and other factors like the microstructural condition in whey and milk and other food products/concentrates sets the limit for solids levels and efficiency in performance of spray drying, as well as other core processing applications such as membrane filtration, thermal treatment and evaporation.



Fig. 1: APV Caviator

The Cavitator has proven its excellence in combined viscosity reduction and microstructural conditioning. The viscosity reduction (temporarily) enables an increase in the solid levels prior to the spray drying and other key processes, thereby, significantly reducing the operational cost. Fig. 2 show a viscosity reduction of 20% in WPC 80 and even with a very high viscosity caseinate product, the Cavitator has demonstrated its capability in increasing the solids level by more than 15% prior to drying.

The particle structure, size and distribution also affect the drying efficiency and performance and the Cavitator has also proven its excellence in de-agglomeration and formation of smaller and homogenous particles size and distribution. Gas injection is known to have a positive impact on the drying performance and the Cavitator has demonstrated a very efficient gas dispersion in e.g. coffee extract with a positive effect on the drying performance and functional properties of the end product.

Microparticulation of WPC and WPI

The well-known APV LeanCrema™ technology for Microparticulation of WPC provides functional ingredients for low fat cheese, yoghurt, ice cream and nutritional beverage and other food products. Fig. 3 shows a high quality nutritional dairy beverage based on microparticulated WPC.



Fig. 3: High protein yoghurt sports drinks

Compared to the Lean Cream System the multi-purpose CaviMaster™ technology enables higher denaturation temperature and very long run time without fouling. It produces very narrow particle sizes of 1-1,5 micron (Fig. 4) ideal for many products. The CaviMaster can improve existing processes and end products as well as facilitate innovation and production of new added-value dairy, food and beverage products with low fat and high nutritional whey proteins. Sweet whey and lactic acid whey or ideal whey from milk fractionation, can be used. The whey source and products can be based on liquid WPC before spray drying or recombined powder WPC / WPI of various grades.

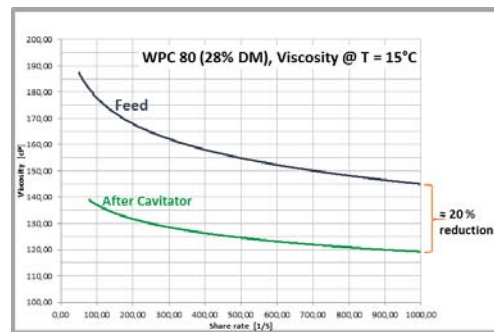
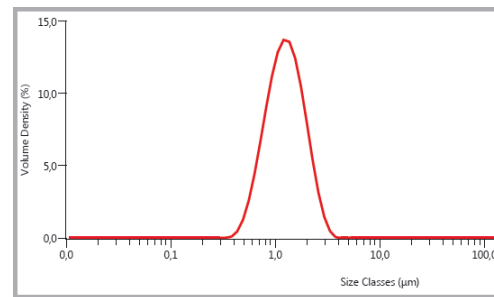


Fig. 2: Viscosity reduction of WPC 80 by controlled hydrodynamic cavitation



Particle size distribution of functionalised WPC

Fig. 4: Microparticulation based on CaviMaster technology

Key applications	Key process / product benefits
Scale-free heating	Thermal processing of WPC and other sensible products without fouling for enhanced run time and reduced operation cost.
Viscosity reduction and structural conditioning	Enhanced processing efficiency and drying performance of milk and whey based concentrates for increased solids and capacity and reduced OpEx.
Powder Mixing and Hydration	Fast dissolving of dairy powder ingredients and gums at decreased temperature and increased solids.
WPC functionalization	Microparticulation of WPC to enhance functional properties in low fat and or protein-enriched nutritional products.
Dispersion & emulsification	Improved emulsion quality with small and narrow particle distribution possibly in combination with homogenisation.
Intensive gas dispersion and liquid contact	Very fine gas distribution and high gas / liquid mass transfer rate for enhanced process performance, functionality, stability and quality.

Table 1: Cavitator technology applications and benefits



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