

Demineralized Whey Powder





Increase Profits and Product Appeal

The growing Infant Formula and sports nutrition industries are driving the extended demand for whey proteins in their specialized formulations. Demineralized whey powder is one of the sources bringing pure healthy options to the industry and at the same time bringing extra margin to milk and cheese producers in the Dairy Industry.

SPXFLOW FOOD + BEVERAGE

As a global leader in the food and beverage, energy and industrial markets, SPX FLOW helps our customers improve the performance and profitability of their manufacturing operations and processes with solutions supported by our in-depth application expertise and a solid customer service and spare parts network.

SPX FLOW focuses on process safety, efficiency and total cost of ownership for our customers.

➤ **Anhydro®**

➤ **APV®**

➤ **Waukesha
Cherry-Burrell®**

➤ **Gerstenberg
Schröder®**

**Seital Separation
Technology**

Product Definition – Demineralized Whey Powder

Demineralized whey powder is obtained by removing a defined portion minerals from pasteurized whey. Typical levels of demineralization are 35%, 70%, and 90%. Demineralized whey is produced by filtration, electrodialysis and ion exchange. The acidity of demineralized whey may be adjusted by the addition of high grade caustic soda.

Nutritional Values

Demineralized whey powder is a vital ingredient in the production of Infant Formula which gives required proteins without having the renal load of minerals on tender kidneys.

Food systems formulated with milk proteins can contribute significantly to the nutritional value of the finished product, offering benefits such as enhancing muscle growth and aiding weight loss.

Additionally, demineralized whey powder delivers improved functionality such as mouthfeel and water binding properties.

SPX FLOW offers complete whey process powder solutions as part of our comprehensive dairy program ranging from whey reception, separation, membrane filtration, evaporation, crystallization and spray drying.



Wide Range of Benefits with Demineralized Whey Powder



Typical Applications

Used in infant foods, dairy, confectionery, and other food and nutritional products as:

- An economical source of dairy solids
- An alternative to sweet whey powder, when lower mineral/ash content and a high lactose content are desired for nutritional or flavour reasons
- An alternative to lactose, when a moderate protein content provides added nutritional or functional advantages



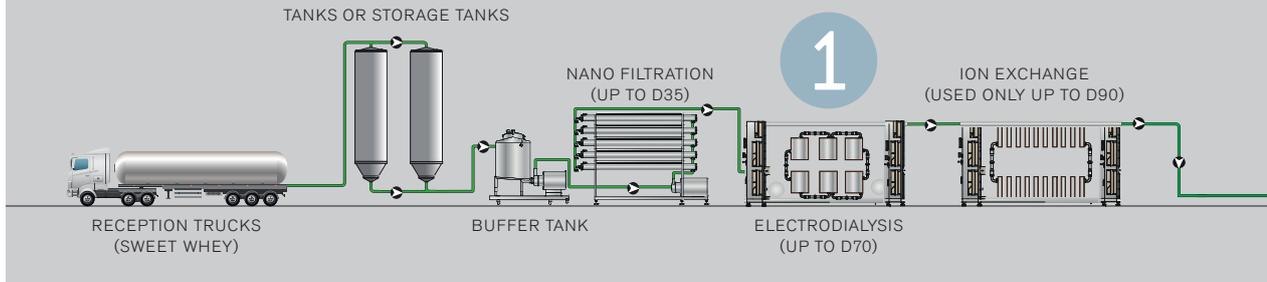
Testing Capabilities

The SPX FLOW Innovation Centres leverage the extensive industry experience and expertise of a permanent staff of food technologists, process engineers, and production engineers – together with knowledge gained over many years to contribute actively to all types of development, testing, and application of SPX FLOW equipment, systems, and processing lines. All facilities and services are designed to provide added value by minimizing waste and energy requirements, or by converting commodity ingredients into new, competitive products.

Important elements of the SPX FLOW Innovation Centres are innovation, optimum plant dimensioning, high quality products, and up-to-date knowledge of market requirements.



Understanding the Process



1 Demineralization

There are three main technologies which can be applied to whey demineralization, depending on the level of purification needed:

- Nano Filtration (NF)
- Electrodialysis (ED)
- Ion Exchange (IX)

TECHNOLOGY	NF	NF + ED	NF + ED + IX
DEMINERALIZATION	30 - 35%	50 - 70%	> 90%
LACTOSE CONTENT	< 74%	74 - 77%	> 80
ASH CONTENT	> 5%	4 - 2.5%	< 1%

Our processing experts consider all aspects of your project including your production capacity and target demineralization rate. Budgets are also key considerations because, while simpler processes are less capital intensive, long term operating costs are higher. While multi-step processes require higher upfront capital investment, they provide significant savings in operating costs and reduce chemical use and effluent output for larger production facilities. While the SPX FLOW portfolio covers all major components, we partner with one of the most specialized and reputable electrodesialysis companies to ensure that your end-product goals are met.

Nano Filtration

Nano Filtration is a process during which an open membrane allows small monovalent ions such as chlorine and sodium to be eliminated. This process allows the concentration and partial demineralization of the whey to be combined into one step.

SPX FLOW's APV Nano Filtration system is designed with proven components and membranes to optimize performance and ensure long membrane life. Our highly engineered systems are delivered pre-assembled and offer easy maintenance and operation.

Benefits:

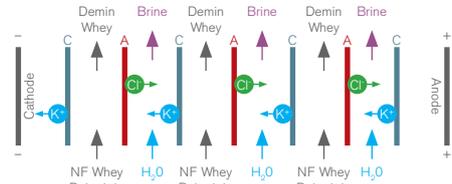
- Competitive demineralization technology for limited demineralization rates of 30-35%, primarily for removing sodium, chlorine, and potassium
- Provides pre-concentration of whey of 18-19% dry matter or higher
- Minimal water and chemicals used
- Highly efficient for whey, which are rich in monovalent mineral ions
- Long run times

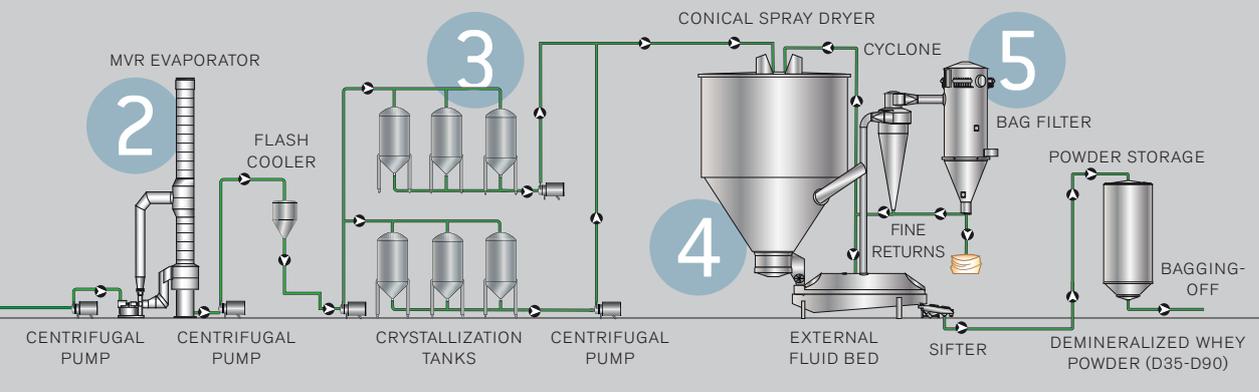
Electrodialysis

Electrodialysis (ED) is an electric driven process enabling the separation of minerals via negatively and positively charged electric fields in a selective membrane system.

Benefits:

- Demineralization of up to 70%
- Low Operating Expenditure (OPEX)
- Makes product suitable to use in Infant Formula and in other food applications





Ion Exchange

Ion Exchange is a process using resins in column or in a batch operation. The resins work as adsorbents of positive and negative ions. The ion exchange typically operates together with electro dialysis, where the feed to the ion exchange is demineralized to approximately 70% prior to the ion exchange process.

Benefits:

- Demineralization of up to 90%
- Makes the product suitable for superior requirements for use in Infant Formula and in other food applications.



2 Evaporation

At the outlet of the demineralization plant, dry matter content is around 18-19% where it is then passed through an evaporator to increase content up to 60-61%. The evaporator is equipped with a flash cooler to bring the concentrate temperature down to 35°C, described further in this brochure.

SPX FLOW's Anhydro evaporator offers two proven evaporation options: Mechanical Vapor Recompression (MVR) and Thermal Vapor Recompression (TVR).

Selecting the optimal heat treatment system and evaporator are essential for achieving the desired product quality and operating costs. Key considerations include:

- Minimal heat impact on sensitive nutrients like whey proteins due to short holding times
- High-efficiency heat transfer
- Integrated vapour separators for compact design and improved milk solids separation
- Low steam consumption (Mechanical Vapor Recompression)
- Low power consumption (Thermal Vapor Recompression)

Flash Cooling

The feed from the evaporator is processed through a flash cooler to bring down the temperature of the concentrate. Flash cooling is the place where crystallization initiates.

The Anhydro flash cooler is a standardized system designed for quick cooling and water evaporation. The system is delivered as a complete unit – pre-wired and tested – resulting in minimal installation time.

Benefits:

- Low energy consumption
- Optimised crystallization in downstream process
- Service friendly units; easy access to all equipment

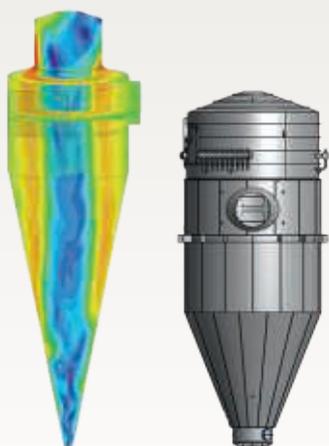
Direct Drive Atomizer



SPX FLOW's Anhydro centrifugal atomizer is energy-efficient and hygienically designed.

Benefits:

- Not belt driven
- No lubrication oil needed
- Light weight
- Compact dimensions
- Easy to maintain



3 Crystallization

After the flash cooler the product is transferred to Anhydro designed and proven crystallization tanks. The amount and size of lactose crystals in the concentrate require a precise cooling and crystallization curve program. SPX FLOW designed a proprietary data analysis program in-house, and we continuously enhance it based on customers' feedback.

Benefits:

- Achieves target lactose crystal size and number
- Converts alpha lactose to alpha lactose monohydrate to produce a non-sticky, non-hygroscopic concentrate
- Prevents powder from sticking in the chamber during drying
- Delivers uniform crystallization of the feed product
- Longer dryer run times

4 Spray Dryer

The optimal choice for drying of demineralized whey is SPX FLOW's Anhydro three-stage spray dryer, designed with a cylinder and a cone, to deliver optimal conditions for atomization. A specific diameter to height ratio in the cylinder ensures that the desired type of atomization is achieved by the centrifugal atomizer. The air distributor is also customized for optimal performance, and the dryer is equipped with an integrated fluid bed as well as an external fluid bed. The dryer is designed with the latest safety equipment to comply with legal and industrial standards.

Benefits:

- Highly efficient three-stage drying process
- Centrifugal atomization reduces wear on spraying nozzles
- Side outlets reduces sticking and is more hygienic compared to bottom U-shaped outlets
- Available with either centrifugal or nozzle atomizer for production versatility (e.g. to produce milk powder on same dryers)
- Flexible layout options



External Fluid Bed

To ensure that the powder is dried and cooled to the desired moisture and temperature. The powder is further conditioned in an Anhydro external fluid bed.

Benefits:

- Energy efficient drying and cooling – vibrating fluid bed
- Hygienic design – fully welded construction; retractable CIP nozzles
- Optimal powder conditioning – unique air stream program

5 Exhaust System

5a. Cyclones

Fines can be separated by means of a cyclone, bag filter or combination of both. Our innovative Anhydro cyclones are designed to efficiently retain fine powder released to the atmosphere or bag filter when air and product leave the chamber. The design of the cyclone is regularly tested and upgraded to meet our customers' product requirements and the computational flow dynamics (CFD) analysis.

Benefits:

- Highly efficient design
- Longer cone for high fines retention
- Reduced product loss
- Compact layout

5b. Bag Filter

SPX FLOW's Anhydro bag filters ensure the longevity of the filter bags and provide efficient filtration before the exhaust air is released to the atmosphere. CFD analysis of the bag filters predicts mechanical stress and determines mitigation measures. The highly efficient bag filters minimize loss of powders into the atmosphere.

Benefits:

- Walk-in plenum
- Clean-in-place (CIP)
- Suppression or rupture disc for safety



Dryer Explosion Safety

Spray drying plants are the core of dairy industries which turn liquid product into powders.

To ensure the safety of personnel and protection of valuable assets, equipment with sufficient built-in safety protection is required.

SPX FLOW's Anhydro spray drying plants are built according to the VDI 2263 standard for controlling explosion risks in drying plants.

The safety system is designed as per ATEX zoning. ATEX Directive 94/9/EC Annex 1 describes equipment safety classification zones. For dust these zones are 20, 21 and 22 with 20 being the highest risk of an explosive atmosphere. Each area of the spray dryer is classified to determine where the risk of explosion is highest and required safety features are employed as mentioned below:



Warning:

Alarm signals and CO detection system



Prevention:

Fire extinguishing nozzles, suppression system and cooling system for atomizer



Protection:

Ruptured disc and venting

Optimized Process Control

SPX FLOW's automated process control system optimizes key process settings such as feed rate, temperature, pressure, holding times, particle size, and moisture content.

Anhydro spray drying plants are controlled from a number of operator stations, providing the operator with end-to-end monitoring of all production parameters.

SPX FLOW control systems deliver plant performance optimization, rapid troubleshooting and real-time recording of critical process data providing complete traceability. Process data can be accessed through a local network or a remote computer with a dedicated connection.



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