APPLICATION SHEET

APV Cavitator Technology in Functionalisation of WPC and other Food Ingredients

A NEXT GENERATION MICROSCOPIC MIXING AND SCALE FREE HEATING TECHNOLOGY

The powerful forces of cavitation produce results that far exceed those of conventional technology

The APV Cavitator is a new breakthrough technology for microscopic mixing, scale-free heating and ingredients functionalisation based on controlled hydrodynamic cavitation.

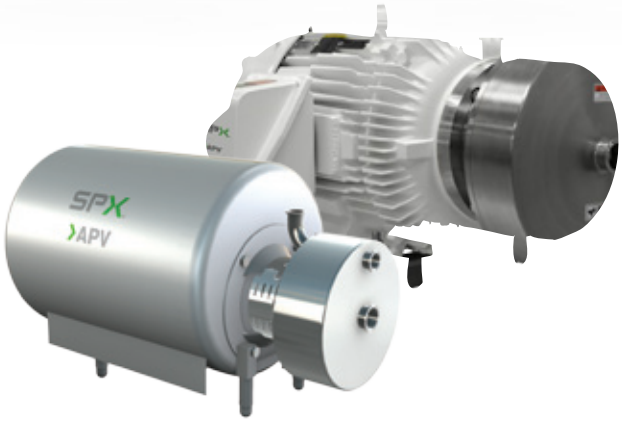
Microparticulation (MP) of WPC combining heat denaturation and ideal particle size distribution in a one-step process solution was launched in 2005 under the brand name of APV LeanCream™.

The LeanCream™ technology was successfully launched for cheese with whey drainage, powder ingredients and protein enriched drinks. The technology is based on a special designed and patented Scraped Surface Heath Exchanger (SSHE) known as the APV Shear Agglomerator (ASA).

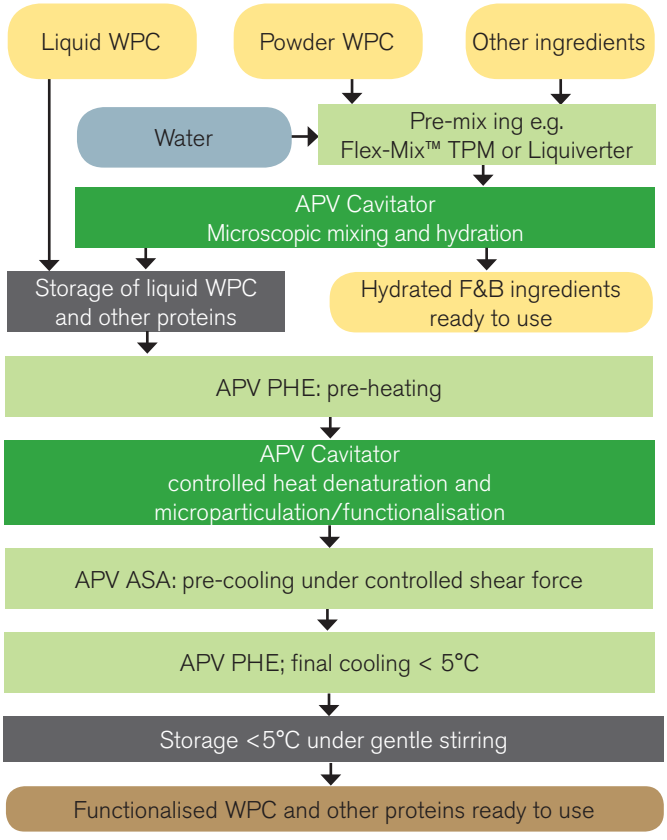
SPX is now launching a next generation breakthrough MP or functionalisation solution based on the new APV Cavitator technology. In addition to highly efficient MP and functionalisation of WPC35 - 80 or higher grades and other potential animal and vegetable proteins the Cavitator can also be used for efficient hydration of the proteins and other minor and major powder ingredients.

A key challenge is to obtain an optimal denaturation degree and particle size distribution of the WPC Functionalised Ingredients (WPC-FI) for use in the food & beverage industry. In addition to those key functions the Cavitator also eliminates fouling of the thermal system ensuring a long run time between CIP. This is also the case for high solids and high protein WPC grades from sweet or lactic whey.

WPC plays an increasing role in nutritional and healthy food products including low orf no fat products. The key benefits



Processing diagram for functionalisation of WPC and other proteins/ingredients



of the FI process are the unique functional properties such as enhanced creamy mouth feel, enhanced water binding capability and emulsification which this technology adds to the WPC ingredients.

Functionalised WPC Food Ingredients (WPC-FI) can be used for a wide range of food & beverage products. Some examples are: Dressings, sauces, mayonnaise and several other processed food applications. Dairy based products like ice cream, fresh cheese, yoghurts and nutritional protein enriched beverages. Furthermore, it can be used for meat, poultry, seafood products as well as confectionary and bakery products. The Cavitator offers a wide range of benefits that meets the customers' needs.

The principle of the APV Cavitator

The heart of the technology is a rotor spinning in a liquid chamber. The rotor has a number of radial holes. The spinning action generates internal liquid friction (disk friction) and the holes generate hydrodynamic cavitation. The cavitation creates high shear ensuring very efficient microscopic mixing effect and friction which generates controllable scale-free heating.

WPC60
before functionalisation

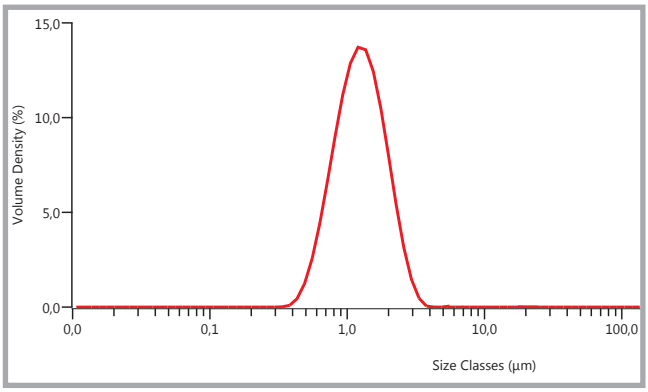
WPC60-FI
after functionalisation

Controlled cavitation is instrumental for new functional properties in healthy food

Use of the APV CaviMaster FI for protein functionalisation and more

The new integrated technology solution branded as the "APV CaviMaster FI" consist of a combined PHE for pre-heating and final cooling, a Cavitator for controlled, scale free heat denaturation and a controlled MP process and finally an ASA for pre-cooling under controlled shear force.

The multifunctional CaviMaster FI can be used for both liquid and rehydrated powder based WPC and also for hydration of the powder WPC and for other proteins and gums etc. Furthermore it can be used for scale free heating, dispersion / low pressure homogenisation, emulsification and aeration.

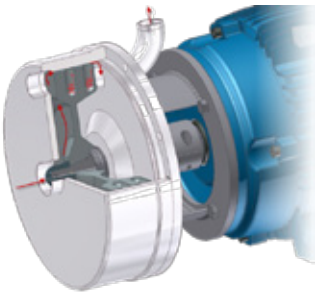


Particle size distribution of functionalised WPC

Features and benefits

The controlled cavitation technology offers several unique features and benefits in microparticulation and functionalisation of WPC and hydration and other functions.

- The excellent microscopic mixing effect eliminates powder agglomerates or "fish eyes" and ensures a fast and short hydration time of major and minor ingredients like proteins and gums etc. The results are often significant savings on raw material, improvement of functional properties and reduced process cycles, and consequently reduced cost.



- Functionalisation of WPC through a controlled denaturation and MP process for very accurate particle size distribution at 1- 1.5 µ, which enhances water binding, emulsification properties, and a creamy taste in low or no fat products.
- The functionalised WPC and other ingredients add significant values to a wide range of end products across the entire food and beverage industry.
- The scale free heating feature enables a more gentle heating and longer run time, resulting in reduced number of CIP cycles with significant savings and enhanced product quality.
- The Cavitator is highly flexibly for a wide range of process functions in addition to mixing MP and functionalisation. These include emulsification, low pressure homogenisation, dispersion of minor ingredients in high viscous products and gas dispersion for foaming or carbonation.
- Controlled cavitation is instrumental for new product developments in transforming natural dairy and other food proteins and components into new dimensions of functional properties and interactions for healthy food & beverage products.
- Highly reliable and sanitary design meeting 3A and EHEDG standards
- Low maintenance time and cost also contribute to the overall reduced OpEx.

Product characteristics and functional properties of WPC-FI:

- **From sweet WPC: Creamy mouth feel and viscosity and colour like coffee cream**
- **From Lactic WPC: Flavour and viscosity like buttermilk**
- **Enhance creaminess in low and no fat products**
- **Water-binding; improved texture and viscosity**
- **Excellent emulsification properties**
- **Enhanced foaming and whipping stability**
- **Soft consistency and enhanced gelation capabilities**
- **Pure dairy based ingredients with high nutritional value**

Examples of WPC-FI applications in dairy, food and beverage products:

- **Dressings, sauces and mayonnaise etc.**
- **Ice cream and frozen desserts**
- **Fresh cheese types**
- **Processed cheese**
- **Fermented milk products**
- **Dairy desserts**
- **Protein enriched nutritional drinks**
- **Nutrition's and powder ingredients**
- **Chocolate, confectionery and bakery**
- **Meat, poultry & sea foods and ready meals**

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