



Cavitation Technology for Beverage Processing

A NEXT GENERATION MICROSCOPIC MIXING AND SCALE FREE HEATING TECHNOLOGY

The latest hydrodynamic cavitation technology enables enhanced resource efficiency in processing and quality of beverages. The APV Cavicator™ ensures highly efficient gas dispersion, microscopic mixing, dispersion and emulsification as well as effective hydration and functionalization and scale free heating of heat sensible products

The rising global demand for high value beverages is being driven by many factors including a growing young population and increased spending power in emerging markets. The high growth nutritional beverage market is further driven by the health and wellness trends with increasing consumer demands for products that are natural, functional, healthy, tasty and convenient. Environmental pressures combined with a highly competitive market place, calling for more diverse and premium products, needs new and innovative processing technologies.

SPX technology for beverage and nutritional drinks categories

SPX is a leading innovative components supplier and its technology is used across beverage categories from beer and other alcoholic drinks to juice, soft drinks, flavoured water and RTD tea and particulate drinks. In addition, SPX has full line processing systems and solutions to meet the growing demands of the nutritional beverage market from non dairy soy, almond, and oat milk to dairy sports drinks with high protein content to a wide range of flavoured drinking milk and fermented milk drinks categories.

Our food technologists are constantly focussing on new ways to support customers with the modern challenges they are facing. SPX's equipment portfolio includes a wide range of flow components, dairy and nutritional beverage process line equipment from dairy based raw materials intake, ingredients mixing and blending, to thermal processing. These may also include partnerships for filling lines.

Supported by leading Innovation Centres, SPX has proven its ability in helping customers develop and produce a wide range of high quality and safe nutritional beverages.



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 which along with the rotor / liquid friction generates controllable, scale-free heating.

The APV Cavicator™, shown in Fig. 1, has multiple applications (Table 1) including gas dispersion, citrus oil dispersion and homogenisation, gentle mixing of fruit pulps, powder ingredients hydration and functionalization and scale free heating of protein drinks. The applications are represented in Table 1 and some of these applications will be further discussed here.



Fig. 1: APV Cavicator

Unique gas dispersion enhancing filling line efficiency

Gas dispersion is a unique and proven feature of the Cavitator. Thanks to its efficient gas dispersion, ideal condition for micro-bubbles are generated in the carbonation (CO₂) or the nitrogenation (N₂) processes in the final beer. O₂ is essential for yeast and a good dispersion of the O₂ promotes the fermentation process. The CO₂ and N₂ enhance flavor, mouth-feel and shelf life in soft drinks, beer and cider etc. when well dispersed as micro bubbles.

The APV Cavitator has proven high efficiency in the carbonation of beer prior to filling (Fig. 2). The Cavitator produces very fine "micro bubbles" when the solution is supersaturated which improves the bottle line efficiency significantly.



Fig. 2: Beer (A2) with and (B2) without Cavitator gas dispersion

The Cavitator reduces the CO₂ bubble size leading to a higher gas surface area creating intensive gas/ liquid contact, and thereby slowing the bubble rise velocity leading to significant benefits in the filling process of beer and beverages.

- Less immediate over foaming during the filling process
- Increased performance and speed of the bottle filler
- Lower product losses, cooling costs and less labelling problems
- Easier cleaning of the bottle filler and filled bottles



Fig. 3: High protein yogurt sports drinks

Enhanced quality, firmness and stability of coffee foam is another successful application. In addition, the nitrogenation enhances the performance of the spray drying of the coffee extract.

High efficient mixing, dispersion and functionalization

The superior mixing, dispersion / emulsification, hydration and scale free heating has proven to deliver significant benefits in both processing and end product quality

- An efficient but gentle mixing of citrus fruit pulps ensures that the fibres / particulates remain substantially intact and secure excellent product stability.
- Fast and efficient hydration of gums, protein powders and tea ingredients enhance yields and resource efficiency in processing.
- Unique dispersion and emulsification of citrus oils and essences ensure high quality and stable end product beverages.
- Microparticulation of WPC provides functional ingredients for protein enriched low fat nutritional beverage with excellent full fat taste (Fig. 3).
- Scale free heating of high protein nutritional drinks enhance the running time and save operational costs.

Key applications	Key process/product benefits
Gas dispersion in beer and beverage - CO ₂ , N ₂ and O ₂	Ideal micro-bubbles in beer and beverage enables increased speed of filling lines with less loss of products. It enhance fermentation and flavour, mouth-feel and shelf life of beer. And it also enhance drying performance of coffee extract and quality of coffee foam.
Oil dispersion and homogenization	Efficient dispersion and emulsification of citrus oil flavours /essences in beverages and RTD products and also Tetra hops oils in beer.
Mixing of pulp with fibres and particulates	Efficient and gentle mixing of fruit pulp maintaining the fibres and particulates and secure stability in citrus pulps.
Powder mixing and hydration and extraction	Fast and efficient dissolving of ingredients like gums, proteins, tea powders and others at low temperature and high solids. Increased starch yield from wort increases the alcohol yield.
WPC functionalization	Microparticulation of WPC to enhance functional properties in low fat and or protein-enriched nutritional drinks and products.
Scale-free heating / pasteurization	Pasteurization of protein drinks without fouling means long run time and lower CIP cost and other operational costs.

Table 1: Cavitator technology applications and benefits



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