APPLICATION SHEET

# APV Cavitator Technology in Brewery, Beverage and RTD Processing

A NEXT GENERATION MICROSCOPIC MIXING AND SCALE FREE HEATING TECHNOLOGY

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

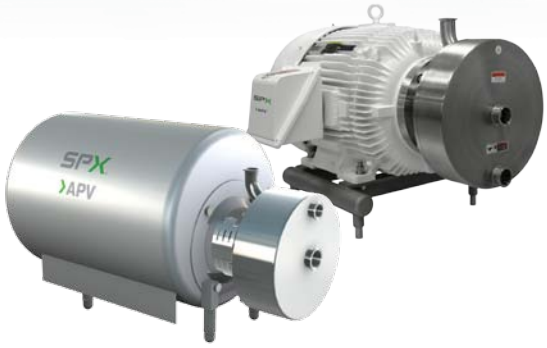
The APV Cavitator is a new breakthrough technology for very efficient microscopic mixing and scale-free heating based on controlled hydrodynamic cavitation. The Cavitator has a number of multiple functions and features that benefit beverage, beer and RTD (Ready-To-Drink) producers.

Controlled cavitation is an excellent solution for extraction of starch, commercialized in ethanol production some years ago. This is also highly relevant in the brewery mashing process to release starch from the grains which becomes more available for fermentation, thus increasing the alcohol yield. Extraction of essence from the hops is another option for the Cavitator as well as dispersion of hop oils in beer in the final stage of the process.

Gas dispersion is a unique feature of the Cavitator. Thanks to its efficient gas dispersion, ideal micro-bubbles are generated in the carbonation ($CO_2$) or the nitrogenation ($N_2$) processes in the final beer. $O_2$ is essential for yeast and a good dispersion of the $O_2$ promotes the fermentation process.

The $CO_2$ and $N_2$ enhance flavor, mouth-feel and shelf life in soft drinks, beer and cider, etc. when well dispersed as micro-bubbles. A potential exists to avoid foaming during filling resulting in faster speed on the filling lines and reduced loss of beer. Enhanced quality and taste of coffee foam is another option.

Other key applications are fast and efficient hydration of powder ingredients inclusive tea powder, dispersion and emulsification of citrus oils as well as gentle mixing of fruit pulp fibers. For drinks with high proteins and other fouling components scale free-heating is another beneficial feature of the APV Cavitator.




## Examples of APV Cavitator applications and benefits in brewery, beverage and RTD's processing

| Key applications | Key process/product benefits |
|---|---|
| Starch extraction in wort production | Increased starch yield in the brew house increases the alcohol yield |
| Powder mixing and hydration | Fast and gentle dissolving of ingredients like hydrocolloids, proteins, tea powders and others |
| Protein (WPC) functionalization | Microparticulation of WPC for enhanced functionality and taste in protein-enriched nutritionals |
| Oil dispersion and homogenization | Efficient emulsification of citrus oil flavor and other oils / essences in beverages and RTD products |
| Mixing of pulp with fibers and further particulates | Efficient and gentle mixing of fruit pulp. E.g. citrus maintaining the fibers and secure stability |
| Gas dispersion in beer and beverage - $CO_2$, $N_2$ and $O_2$ | Ideal micro-bubbles enhance beer fermentation and flavor, mouth-feel and shelf life of beer and beverage. It also enables increased speed of filling lines with less loss of products. Enhance coffee foam quality/taste |
| Scale-free heating / pasteurization | Pasteurization of protein drinks without fouling means long run time and lower CIP cost and OpEx. |

## 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 frictions (disk friction) and the holes generate hydrodynamic cavitation. The cavitation create high shear ensuring a very efficient microscopic mixing effect and friction which generates controllable scale-free heating.

## Use of the APV Cavitator in beer and beverage processing

Examples of Cavitator applications in beer, beverage, RTD and nutritional drinks appear in the table overview. There are undoubtedly more applications in pre-processing and in the main processing steps as well as mixing of post additions before filling.

The APV Cavitator can work as a single operation unit for functionalization of ingredients including hydration, pulp mixing and emulsification, or it can be fully integrated in a process line for gas dispersion and scale free-heating. A unique and beneficial feature of the Cavitator is its ability to perform multi functions in one single process step, e.g. scale free heating in combination with dispersion, homogenization or emulsification.

SPX provides technology guidance for the most optimal process set up and process integration to obtain maximal overall benefits and value of the Cavitator.

## Features and benefits of the APV Cavitator in beer, beverage and RTD processing

- Controlled cavitation can be used for extraction of starch to increase alcohol yield. Extraction of essence from the hops and dispersion of hop oils in beer are other options.
- The Cavitator is very efficient for dispersion of any gas media like $CO_2$ and $N_2$ resulting in formation of micro-bubbles which enhance flavor, mouth-feel and shelf life in soft drinks, beer and cider. As it reduces foaming during filling, the speed of the filling line can be increased and the loos of beer reduced.

- Pre-emulsification of citrus and other oils helps reducing homogenization pressure and producing a more stable emulsion.
- The efficient and gentle microscopic mixing of e.g. gums, proteins and tea powders results in a complete hydration thus creating product savings, a shorter process cycle and lower OpEx. Gentle mixing of fruit pulps, maintaining fibers and ensuring stable products, is another benefit.
- The Cavitator has no heat transfer surface, making the Cavitator a potential heating device for high fouling and heat-sensitive products like nutritional drinks with high protein, chocolate drinks, etc. The result is longer run time and shorter CIP cycles with lower OpEx.
- Other key features and benefits of the APV Cavitator
  - Highly reliable and sanitary design meeting 3A and EHEDG standards
  - Low maintenance time and cost also contribute to the overall reduced OpEx.



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