Ice cream processing

How to add greater efficiency and improved product quality

(photo: SPX)

For many years, ice cream manufacturers followed the same process using the same technology; using atmospheric mixers to provide a pre-emulsification process before homogenisation. The increasing use of milk based powders and need for better hydration, however, has led to a requirement for better mixing performance from this production step. Modern machine development has led to improvements which have been well received by the industry, with new mixing options that provide better dispersion, increased operational efficiency and improve final product quality.

Improving the pre-mix process

The mixing process is at the heart of good ice cream production. Traditional atmospheric mixers do not necessarily offer the best results and their use creates a number of challenges to the process. Although easy to understand and operate, the open gravity feed for an atmospheric mixer makes hygienic levels more difficult to maintain and gives the potential for moisture to enter the dry powder mix. The vortex depended operation of such a mixer often results in larger particles in the pre-mix with wider distribution. Additionally, air can easily enter the mixture, which can create fur-

ther problems and undesirable characteristics, for both the quality and processing conditions.

The challenges presented by atmospheric mixers have led major ice cream producers to change to vacuum mixers in the pre-mix stage of production. The benefits to be gained through the use of machines such as the APV Flex-Mix Instant Vacuum mixer from SPX, can mean lower installation cost, lower overall production costs and better quality results.

In vacuum mixing, powder is directly dosed into the liquid at high speed which facilitates good dispersion and dissolution. Because the system does not use a gravity feed, machine installation is more compact and on a single level, making the addition of minor ingredients easier for operators. This simplified installation also makes maintenance easier with more accessible components. The closed system prevents dust from forming and prevents powders from absorbing any atmospheric moisture. The complete separation of wet and dry materials improves hygiene production.

The use of vacuum mixing increases productivity as integrated deaeration minimises the required hydration time for pre-emulsions after pre-mixing. The removal of air from the mixture reduces fouling on the plate heat exchanger (PHE) later in the process and improves homogeniser reliability. This increases run times, reduces CIP frequency, extends production capacity and lowers maintenance costs.

The fine, consistent emulsion particle sizes created by vacuum mixing helps to make uniform homogenisation easier and enables the process to be carried out at lower pressure with high quality end results. The improved mixer performance can also handle more challenging recipes with better solubility handling of more hygroscopic ingredients.

The impact a vacuum mixer has on production makes it an overall more cost effective solution than an atmospheric alternative. It offers significant savings in installation costs, with no need for raised platforms. Furthermore, it reduces energy costs, with the savings of lower homogeniser pressure and reduced fouling on the PHE far outweighing the running cost of the vacuum pump. Longer run times and easier maintenance add yet more benefit to this solution. Once vacuum and flow are set, the reliable system also requires less manpower to supervise.

Upgrade of existing processing lines

A vacuum mixer has real benefit in new installations and can be shown to significantly reduce total cost of ownership. Where an existing processing line exists, alternative technologies may also be considered to offer improved performance. The break through APV Cavitator from SPX is an innovative in-line microscopic mixing/hydration and homogenisation solution which can be added in between the pre-mix buffer tank and pasteuriser for improved pre-mixing results and scale free heating.

At the heart of the Cavitator technology is a rotor, which has a number of radial holes and is spinning in a liquid chamber. The spinning action generates internal liquid frictions (disk friction) and the holes generate hydrodynamic cavitation. The cavitation creates locally intense shockwaves ensuring a very efficient microscopic hydration and mixing effect. The friction generates controllable heating and, as the Cavitator has no heat transfer surface, there are no hot or cold spots to cause scaling or fouling.

At the pre-mixing stage of the ice cream production process, the Cavitator can help optimise the hydration of ingredients and functionalization of whey protein concentrates (WPC). The Cavitator process will result in a complete hydration of the key components, many formulations contain unnecessary high levels of raw materials to compensate for insufficient mixing and hydration. This creates additional savings opportunities in raw materials usage, and provides similar downstream processing benefits to the vacuum mixer, creating fine emulsions with narrow particle size distribution to make homogenisation and pasteurisation easier to achieve.

As well as offering clear benefits in pre-emulsification, the Cavitator can be utilised with the PHE to form a combined scale-free pasteurisation and dispersion step. Its compact form makes it ideal for creating process improvements to existing facilities, but its impressive performance further improves the characteristics of the ice cream premix even when a vacuum mixer is being utilised.

The Cavitator is suitable for improved pre-mixing results and scale-free heating (photo: SPX)

The APV Flex-Mix Instant mixer is the heart of good ice cream production (photo: SPX)