Safety and Quality in Infant Formula

Newsletter
Safety and Quality in Infant Formula

The best processing results are achieved through co-creation of production lines with its customers. This close partnership encourages the sharing of expertise and specialist knowledge; gives clear understanding of expected key performance indicators (KPIs); drives project efficiency; and offers the potential to exceed system performance expectations. The result is that everyone wins – the food manufacturer, the technology provider, and the consumer.

Infant formula or other powder based early life nutrition (including baby milk, follow on milk, and growing up milk) requires the strictest food safety and quality standards. To meet the demands of this marketplace, producers want absolute certainty in hygiene and food safety while protecting the nutritional value of the product. Other factors that impact powder quality classification include the level of scorched particles, solubility index, color, structure, and other functional parameters. These are important considerations in the design of a processing line and the final value of the infant formula.

INFANT FORMULA PROCESSING

There are many stages in a complete process line for producing infant formula and consideration needs to be taken for the type of ingredients, their quality, and their application (liquid, powder in wet or dry compounding). Each stage requires careful design to ensure the highest quality and food safety are maintained and that the plant is efficient, flexible, and reliable.

Mixing

The first main step in producing infant formula is mixing. The quality of mixing has a big impact on end product quality and, where solids and liquids need to be combined, good dispersion is essential. To optimize quality and hygiene, it’s recommended to use a vacuum mixer. There are many production benefits to a closed vacuum mixer including reduced mixing time, greater energy efficiency, reduced waste and easy maintenance; but for the purposes of this article let’s look at quality and safety issues it addresses.

During vacuum mixing, powder is sucked in from a closed powder hopper or bag system. Using the vacuum level in the tank, the powder is washed out directly into the circulating liquid below the liquid surface; ensuring dust is not released into the surrounding atmosphere. The wet and dry phases of the process are thereby completely separated, reducing the risk of bacteria formation. A vacuum prevents air from entering the mixture, reducing undesirable effects such as oxidation, nutritional degradation, and discoloring. The high shear pump is located at the side of the mixer, which gives added ergonomic benefits including easy access and a safe environment for maintenance.

Evaporation

The next main stage in the infant formula manufacturing process is an evaporation stage, which is an energy efficient method of increasing total solids of the formula. An evaporator works by adding heat to the solution to a point where liquids turn into vapor and can be separated. The type of evaporator selected will depend upon local energy costs. Mechanical vapor recompression evaporators use a mechanical compressor or fan to compress the vapor and need ample electricity supply. Thermal vapor recompression systems use steam jets for compression and require a ready supply of steam to be available. The cost of steam versus the cost of electricity is, therefore, one of the primary considerations in selecting an evaporator for a particular plant.

The evaporator temperature is related to the evaporation pressure. System parameters are adjusted to optimize for product concentration and product quality as well as energy efficiency. Some plants select to use two evaporators which enable continuous production as one line is cleaned, the other is in operation; facilitating 24/7 production.

Using an evaporator reduces the energy required for spray drying and also helps extend the shelf life of the final product by removing occluded air from the fluid.
UHT Treatment
Heat treatment technology like SPX FLOW Instant Infusion is used for the production of infant formula because it provides food safety, nutritional quality protection. The process is a gentle form of heat treatment that involves preheating to 75 degrees to 85 degrees Celsius using plate and tube heat exchangers followed by rapid super-heating to around 140 degrees Celsius using steam infusion. The product is distributed in the form of thin strings into a chamber and is instantly heated by direct steam.

A short, accurate holding time in the range of 0.1 to 0.5 seconds avoids damage of essential amino acids, proteins, and vitamins that can result in nutritional degradation, unacceptable flavor changes, and the formation of burnt particles. The high temperature gives exceptional kill rate and eliminates even heat-resistant bacteria spores.

Optional Cavitation
A rotor with machined cavities spinning in a liquid chamber that generates controlled cavitation. The process increases spray drying efficiency by reducing fluid viscosity and enabling an increase in solids level as well as adding microstructural conditioning that optimizes particle structure, size, and distribution of solid components.

Combined High Pressure Pumping and Homogenization
Homogenizers are not complicated pieces of equipment but correctly designing and applying them requires skill and understanding. Homogenization helps with controlling final product quality, especially the levels of free fat which effect stability of the infant

VEGETABLE OIL
OR HOT WATER

MINOR INGREDIENTS

FINE RETURNS

MAGNET PACKING INFANT FORMULA

HEATING

INSTANT INFUSION

HEAT TREATMENT

CHAMBER

CENTRIFUGAL PUMP

CENTRIFUGAL PUMP

COMPOUNDING TANK

COMPOUNDING TANK

HOMOGENIZER

POWDER STORAGE

MVR

EVAPORATOR

CENTRIFUGAL PUMP

CENTRIFUGAL PUMP

WEIGH HOPPER

CAVITATOR (OPTIONAL)

TRIPLE A SPRAY DRYER

CYCLONE BAG FILTER

FLEXMIX INSTANT/VACUUM MIXING

STORAGE SILOS

OVERALL FLOW DIAGRAM
Formula. Homogenizers act as a high pressure pump feeding the product to the spray dryer.

Spray Drying
The main part of the latter processing stages for infant formula production involves a spray dryer. This process is vital to final product quality and gives complete control over characteristics such as density, moisture content, powder properties, and sensorial aspects. As there is no further heat treatment, it is imperative that product contamination is not allowed. To this end, the air supply to the dryer uses HEPA filters and systems are designed for straightforward cleaning, to minimize the risk of cross-contamination and to maintain food safety.

For example, SPX Flow’s Anhydro Triple A spray dryer incorporates an internal fluid bed. This supports formation of strong powder agglomerates before entering the external fluid bed that further dries and cools the formula ready for packing. This efficient cooling of powder helps maintain quality during storage.

Both internal and external fluid beds in the drying stages of the process are self-emptying. This helps minimize contamination at product changeover, reduces loss of powder in the system, and also ensures powder is out of the system for a more effective clean-in-place cycle.

During spray drying the very fine powder and air is transferred to cyclones for separation. The powder fines can be returned to various positions in the process via a flexible fines return system that can further improve agglomeration.

Drying of infant formula powders also presents an explosion risk and comprehensive safety equipment is required to ensure protection of plant and personnel. Rupture chambers, vent ducts, firefighting systems, carbon monoxide detection systems, and suppression systems are all included in the design of a spray dryer.

Automation Systems
Another important part of an infant formula processing line is automation. Modern systems help ensure reliability and optimized operating costs but they also add flexibility, traceability, assist with the control of quality, and enhance overall operational safety of the system. Full integration with enterprise resource planning systems accurately measures performance and provides real-time data to monitor product quality and need for proactive maintenance to keep the system running reliably and consistently.

SUMMARY
The production of powder based nutrition involves many process stages, all of which require careful integration and design to ensure the desired product quality and maximum food safety is achieved. To ensure all KPIs are met and high consumer confidence in a product brand, a close working relationship between processing companies and technology providers has been shown to yield the best results—offering efficiency, consistent quality, and assured food safety at every stage of the processing line.

Each stage of the process requires understanding of the technology and the internal impact it has on the infant formula to maintain and control its desired characteristics. Achieving the highest standards of safety and quality does not mean manufacturers of infant formula need to compromise on production efficiency and flexibility. Systems are designed to meet the needs of today and the future, covering areas such as advanced powder nutrition for all life stages. Features and functions that provide food safety and plant safety are integrated into the plant throughout production stages, brought together with modern automation systems that help protect and control the whole process.