SPX Anhydro Safety and Environmental Protection for Modern Spray Drying Plants

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The Indian dairy market is growing at a tremendous rate. Inrecent edition, Outlook Business India reported that this market is expected to more than double from the current 10 billion USD in current year 2014 to 24 billion USD (18 billion EUR) in 2020. The publication further commented that value added products such as baby foods are poised for double digit growth rates, which would require a corresponding direct growth in processing capacities. It also detailed the use of skim milk powder in reconstitution, ice-creams, Dahi, etc., forecasting the demand for this product to grow in absolute terms.

Private dairy companies, multinationals and co-operatives will have a need to increase milk drying capacities to meet the increasing domestic demand. Such expansion will also offer potential for substantial business growth through international exports.

Spray drying plants are at the heart of the 'factory' which dries the liquid milk to milk powder. To ensure the safety of personnel and protection of valuable assets, equipment with sufficient built-in safety protection is required. A growing awareness about sustainability and protection of the environment also requires systems be designed for efficient ongoing operation.

There are a number of major safety issues to be addressed in modern spray drying plants and each plant needs to be specifically designed for its particular purpose and conditions. The supplier, customer and local authorities need to work together to evaluate and ensure all safety requirements are met to protect personnel, equipment and the environment.

There are several areas of legislation which apply to spray dryer plant manufacturers in Europe:

- The Machine Directive 2006/42/EC gives safety precautions relating to the mechanical construction of the plant.
- ATEX Directive 94/9/EC Annex 1 describes equipment safety classification zones and all products supplied within the EU into potentially explosive atmospheres must comply with this Directive. For dust these zones are 20, 21 and 22 with 20 being the highest risk of an explosive atmosphere. Each area of the spray dryer is classified to determine where there is most risk of explosion.
- VDI 2263 (re-issued in December 2011) and the corresponding EN 14.491 describe the safety evaluation required when constructing a spray dryer and the ATEX zones in the various parts of the plant. The latest version of VDI 2263 brings more clarification to the regulation and deals with defining the correct zones within the spray dryer. The rules combine equipment design pressure and corresponding relief area or suppression by injection of inert material for each explosion class (defined by the rate of pressure rise or Kst figure) of powder and maximum pressure (Pmax). Powders with Kst less than 200 bar m/s are defined as Class 1, between 200 and 300 bar m/s Class 2 and Class 3 is for greater than 300 bar m/s.

Based on the assessment of materials, process and application, each spray dryer is individually designed to resist the required maximum pressure and provide adequate explosion suppression or relief areas to safe zones with rupture discs on the drying chamber.

* The standards detailed below are followed in the European market to improve plant safety and protect production equipment. Indian legal safety standards need to be studied in line with those given below to effectively use available technologies for Powder Plant safety.

Risk of organic powder dust explosion

An organic powder may explode if there is an ignition source (oxygen and a spark) within the plant. Each organic product needs to be tested and its explosive properties ascertained. The system needs to be designed to resist a given pressure and provide an adequate relief area or suppress an explosion by injecting an inert substance. Suppression may be advantageous on fluid beds, powder ducts and cyclones.

Many dairy whiteners and baby foods contain vegetable oil. The vegetable oils are volatile and it is important that the feed material is well homogenised before the drying process takes place.

Safety equipment recommended on milk spray dryer

The following safety equipment is required to protect a plant against serious damage in the event of sudden pressure or temperature rises:

Pressure Rupture Discs

These are designed to burst whenever the pressure inside a component exceeds a certain value and are manufactured in accordance with Standard VDI 2263 and EN 14491.

A rupture disc consists of:

- Bursting membrane
- Support frame with flanges
- Built on electric wires for indicating when rupture takes place.

The rupture discs are installed at the following positions:

- Drying chamber cylinder. Chamber design: 0.6 bar
- Bag filters.

Vent Ducts

These are used to vent any pressure waves away from the relief panels to the atmosphere. Constructed of stainless steel, these ducts are straight and, where necessary, equipped with weather protection.

The free area for pressure relief and pressure shock resistance of components is calculated following the EN 14.491 Norm for powders belonging to St. 1 dust class (Kst =200 bar m/s and Pmax. 9.0 bar).

Fire Fighting System

Fire fighting systems are provided in the form of nozzles built into plant equipment which spray water into the plant in the event of temperature rising beyond a given limit. A separate temperature sensing system will automatically open the valve for the water when the temperature reaches a critical value. The system is hardwired and connected via a PLC (Programmable Logic Controller).

Water spray nozzles are installed in the drying chamber, bag filters and external fluid bed.

CO Detection System

This monitors the CO level in the inlet and the outlet air and consists of a gas analyser, PLC system, hard-wired power supply, back-up battery, sensor at the main air inlet and sensors after the bag filters. It measures CO from 0-10 ppm.

The inlet CO value is compared with the CO level in the outlets and, if the difference is too great, the system generates warnings, alarms and, eventually, initialises shut-down. The system will trigger an alarm at a pre-set level and, at a higher pre-set level, activate the fire extinguishing system.

Suppression System

In the event of a critical rise in pressure, this system injects fire suppression material into the external fluid bed in the duct between the EFB and cyclone. It incorporates a total of three suppression bottles installed on the plant, each of which contain fire extinguishing material at a high pressure. A set of pressure rise and infrared detectors is used to activate the detonator at each cylinder, whereby material will immediately be injected into the plant.

New directives from ATEX, Europe region

Safety considerations for spray dryers where there is a potential for an explosion have developed.

Instead of just classifying a whole operation as a particular zone the design now looks separately at different parts of the plant and areas inside the spray dryer to assess risks and safety requirements. Ongoing new directives from ATEX and the Machine Directive continue to push up standards and improve safety for personnel.

Ultimately the spray dryer supplier designs a customised solution based on the specific customer requirements and Hazop procedures. A dedicated team will focus on safety issues to ensure the safety of every spray dryer produced. Whatever the application, the customer must be convinced that it is safe to operate the plant and it complies with all the safety regulations.

The SPX Anhydro product range offers the very latest in spray and fluid bed drying technology. They cover small scale and large scale dairy & food applications. They come with particular expertise for the drying of products in the dairy industry including milk powders, milk protein concentrates (MPC), whey protein concentrates (WPC), caseinates, probiotic powders whole milk powder with high free fat content, baby formula, heat classified milk powders and yogurt powders. The ranges include Triple A three stage dryer, conical spray dryers, tall form dryers, spray bed dryers and fluid bed dryers.

About SPX

Based in Charlotte, North Carolina, SPX Corporation (NYSE: SPW) is a global Fortune 500 multi-industry manufacturing leader with approximately $5 billion in annual revenue, operations in more than 35 countries and over 14,000 employees. The company's highly-specialized, engineered products and technologies are concentrated in Flow Technology and energy infrastructure. Many of SPX's innovative solutions are playing a role in helping to meet rising global demand for electricity and processed foods and beverages, particularly in emerging markets.

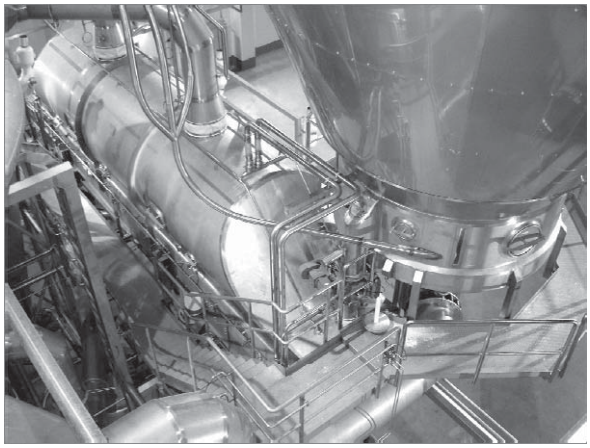

Fig. Anhydro chamber with integrated and external fluid bed for drying

The company's products include food processing systems for the food and beverage industry, critical Flow components for oil and gas processing, power transformers for utility companies, and cooling systems for power plants. For more information, please visit www.spx.com.