Life Sciences

INDUSTRY

- **Control and sequencing**
- **Recipes**
- **Batch control and reporting**
- **Setpoint programming**
- **Bespoke displays**
- **Alarm management**
- **21 CFR Part 11**

The Spray Drying Process

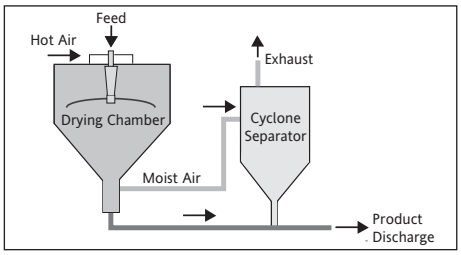
Application Note

The spray drying process is older than might commonly be imagined. Earliest descriptions date from 1860 with the first patented design recorded in 1872. The basic idea of spray drying is the production of highly dispersed powders from a fluid feed by evaporating the solvent. This is achieved by mixing a heated gas with an atomised (sprayed) fluid of high surface-to-mass ratio droplets, ideally of equal size, within a vessel (drying chamber), causing the solvent to evaporate uniformly and quickly through direct contact.

Spray drying can be used in a wide range of applications where the production of a free-flowing powder is required. This method of dehydration has become the most successful one in the following areas:

- Pharmaceuticals
- Bone and tooth amalgams
- Beverages
- Flavours, colourings and plant extracts
- Milk and egg products
- Plastics, polymers and resins
- Soaps and detergents
- Textiles and many more.

Almost all other methods of drying, including use of ovens, freeze dryers or rotary evaporators, produce a mass of material requiring further processing (e.g. grinding and filtering) therefore, producing particles of irregular size and shape. Spray drying on the other hand, offers a very flexible control over powder particle properties such as density, size, flow characteristics and moisture content.



Design and Control

The challenges facing both designers and users are to increase production, improve powder quality and reduce costs. This requires an understanding of the process and a robust control implementation.

Spray drying consists of the following phases:

- Feed preparation: This can be a homogenous, pumpable and free from impurities solution, suspension or paste.
- Atomisation (transforming the feed into droplets): Most critical step in the process. The degree of atomisation controls the drying rate and therefore the dryer size. The most commonly used atomisation techniques are:
  1. Pressure nozzle atomisation: Spray created by forcing the fluid through an orifice. This is an energy efficient method which also offers the narrowest particle size distribution.
  2. Two-fluid nozzle atomisation: Spray created by mixing the feed with a compressed gas. Least energy efficient method. Useful for making extremely fine particles.
  3. Centrifugal atomisation: Spray created by passing the feed through or across a rotating disk. Most resistant to wear and can generally be run for longer periods of time.

- Drying: A constant rate phase ensures moisture evaporates rapidly the surface of the particle. This is followed by a falling rate period where the drying is controlled by diffusion of water to the surface of the particle.
- Separation of powder from moist gas: To be carried out in an economical (e.g. recycling the drying medium) and pollutant-free manner. Fine particles are generally removed with cyclones, bag filters, precipitators or scrubbers.
- Cooling and packaging.

A control system must therefore provide flexibility in the way in which accurate and repeatable control of the spray drying is achieved and will include the following features:

- Precise loop control with setpoint profile programming
- Recipe Management System for easy parameterisation
- Sequential control for complex control strategies
- Secure collection of on-line data from the system for analysis and evidence
- Local operator display with clear graphics and controlled access to parameters

Eurotherm® Eycon™ Visual Supervisor

The Eurotherm® visual supervisor is ideal for autoclave applications because it combines all these key features into a single compact unit:

- **Powerful loop and sequence control**
- **Flexible graphics**
- **Setpoint programmer**
- **Batch control and reporting**
- **Audit trail**
- **XGA touchscreen display to IP65**
- **Secure data logging and trending**
- **Recipe management**
- **Alarm management**
- **Access control and electronic signatures**

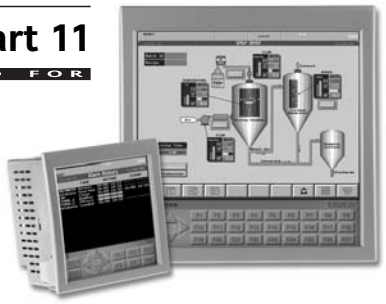
21 CFR Part 11 - 'Ready to use!'

Spray drying plants are used in industries likely to require validation to the requirements of the FDA, EMEA or other applicable regulatory body. The visual supervisor has been widely used in validated processes including freeze dryers, autoclaves, reactors, fermenters, purified water systems, tablet coating machines, etc.

The Auditor feature on the visual supervisor has been specifically designed to meet the requirement of the FDA's 21 CFR Part 11 including:

- Controlled user access
- Secure data logging in tamper resistant format
- Audit trail recording user actions and changes to process parameters
- Electronic signature

21 CFR Part 11
ENHANCED FOR



With the Auditor feature, Electronic signature is configurable for all actions which may be performed from the visual supervisor display including the customised display and standard features such as batch, recipe changes, access control changes, etc.

Scalable architecture

A complete system can be created in combination with T2550 DIN rail I/O bases. Connection is via ELIN and I/O is scalable by adding 4. 8 or 16 slot bases as required. A range of I/O modules caters for the various interfaces required:

Analogue inputs	Inlet and outlet temperatures, feed pump speed and pressure, air flow rate, particle size, humidity
Analogue outputs	Fan and pump speeds, pressure regulators
Digital inputs	Fan and pump statuses
Digital outputs	Fan and pump controls

System building blocks:

- Spray dryer (single Eycon™ visual supervisor)
- Multiple units with supervisory workstation(s)

Eurotherm: International sales and service

AUSTRALIA *Sydney*
T (+61 2) 9838 0099
E *info.au@eurotherm.com*

AUSTRIA *Vienna*
T (+43 1) 7987601
E *info.at@eurotherm.com*

BELGIUM & LUXEMBOURG *Moha*
T (+32) 85 274080
E *info.be@eurotherm.com*

BRAZIL *Campinas-SP*
T (+5519) 3707 5333
E *info.br@eurotherm.com*

DENMARK *Copenhagen*
T (+45 70) 234670
E *info.dk@eurotherm.com*

FINLAND *Abo*
T (+358) 22506030
E *info.fi@eurotherm.com*

FRANCE *Lyon*
T (+33 478) 664500
E info.*fr@eurotherm.com*

GERMANY *Limburg*
T (+49 6431) 2980
E *info.de@eurotherm.com*

HONG KONG & CHINA
T (+85 2) 28733826
E *info.hk@eurotherm.com*

Guangzhou Office
T (+86 20) 8755 5099
E *info.cn@eurotherm.com*

Beijing Office
T (+86 10) 6567 8506
E *info.cn@eurotherm.com*

Shanghai Office
T (+86 21) 6145 1188
E *info.cn@eurotherm.com*

INDIA *Chennai*
T (+91 44) 24961129
E *info.in@eurotherm.com*

IRELAND *Dublin*
T (+353 1) 4691800
E *info.ie@eurotherm.com*

ITALY *Como*
T (+39 31) 975111
E *info.it@eurotherm.com*

KOREA *Seoul*
T (+82 31) 2738507
E *info.kr@eurotherm.com*

NETHERLANDS *Alphen a/d Rijn*
T (+31 172) 411752
E *info.nl@eurotherm.com*

NORWAY *Oslo*
T (+47 67) 592170
E *info.no@eurotherm.com*

POLAND *Katowice*
T (+48 32) 2185100
E *info.pl@eurotherm.com*

SPAIN *Madrid*
T (+34 91) 6616001
E *info.es@eurotherm.com*

SWEDEN *Malmo*
T (+46 40) 384500
E *info.se@eurotherm.com*

SWITZERLAND *Wollerau*
T (+41 44) 7871040
E *info.ch@eurotherm.com*

UNITED KINGDOM *Worthing*
T (+44 1903) 268500
E *info.uk@eurotherm.com*
www.eurotherm.co.uk

U.S.A. *Leesburg VA*
T (+1 703) 443 0000
E *info.us@eurotherm.com*
www.eurotherm.com

ED53