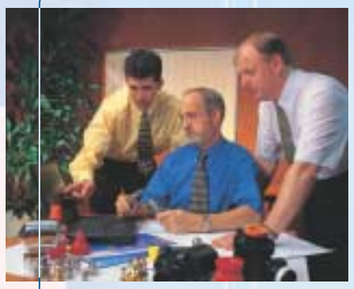
Delavan

Technical know how..

...the critical factors affecting the spray quality.



The Atomiser

Delavan recognises that at the "heart" of any spray dryer is the atomiser, small in size, big in importance, installing the right atomiser is essential to spray drying success.

The atomiser must fulfil several important functions.

1. It must disperse the feed material into small droplets, which should be well distributed within the dryer and mixed thoroughly with the hot gas.
2. The size of the droplets produced must be compatible with the required product particle size characteristics,
3. The droplets produced must not be so large that they are incompletely dried, nor so small that product recovery is difficult. Small particles may also overheat and become scorched.
4. The atomiser must also act as a metering device, controlling the rate at which the material is fed into the dryer.

Consequently, the atomiser, though relatively inexpensive, is therefore an extremely critical element.

Centrifugal Pressure Nozzles

The **SDX™** nozzle represents Delavan's range of centrifugal spray drying nozzles. Energy for atomisation is supplied solely by the feed liquid pressure, with pressures up to 700 bar being used.

The **SDX™** range is of the swirl type configuration using a single inlet swirl chamber and has the capability of atomising liquids having viscosities up to several hundred centipoise.

All the **SDX™** nozzles uses a similar design swirl configuration with orifice discs, thereby guaranteeing uniformity of performance across the range.

Two-Fluid Nozzles

In two-fluid nozzles, gas (or steam) supplies most of the energy required to atomise the liquid. Liquid admitted under low pressure may be mixed either internally or externally with the gas. Although energy requirements for this atomiser are generally greater than the spinning disks or pressure nozzles, the two-fluid nozzle can produce very fine atomisation, particularly with viscous materials. It is often used in laboratory and small spray dryers.

Spray Quality and Particle Size

Whilst durability is one of the foremost requirements of pressure nozzles, atomisation quality is certainly just as critical. The importance of droplet size is often more critical than in other spray operations. Droplet size affects not only dryer size and operating efficiency, but also the characteristics of the final product.

Particle size is critical with regard to bulk density, solubility and customer acceptance.

Distinguishing between droplet size and particle size is important, since the two are generally not identical, although the relationship between the two can often be determined, usually by on-site trials.

Particle size, or droplet size is usually expressed in terms of a mean or average diameter as well as the range or spread in size. As discussed in Delavan's "Spray Droplet Technology" booklet, there are several definitions of mean diameter.

Droplet Diameters

Delavan uses the Sauter mean diameter, whose ratio of volume to surface area is equal to that of the aggregate spray, to measure the droplet diameter.

The range or spread in droplet size requires an understanding of the entire distribution. Typically, a spray drying nozzle will produce droplets as small as 1 to 2 micron and as large as 400 to 500 micron. However, the majority will be within a range of 50-200 micron. The narrower the range of droplet size the more suited it is to spray drying, with a "mono -range" being the ultimate goal for most operators.

Spray Angle

The spray angle in spray drying is usually in the 60° to 90° band. It must be noted that the spray angle measured near the orifice may not prevail further away. This is particularly true at high pressures, when the angle becomes actually narrower within a short distance. Therefore it is important to establish the exact manner in which this spray angle is measured.

Flow Variation

SDX nozzles may also act as metering devices, controlling the distribution of feed into the chamber. Whether single or multi - nozzle application are used the flow rate must be precisely controlled to be compatible with the dryer design.

It is important therefore to understand the properties of the feed material.

As there are so many different feed stocks, all of **Delavan's** calculations are based on water and variations of viscosity etc. are taken into account in **Delavan's** computer analysis programmes.

Liquid Properties

Understanding of the feed stock is essential. The properties of the feed stock are directly related to the finished particle size, therefore density, viscosity, percentage solids, abrasive awareness and any other characteristics all need to be considered

The liquid properties should be established at the temperature corresponding to the liquid in the nozzle. Feed stocks are often sprayed at elevated temperatures to decrease viscosity, thereby improving atomisation.

The effect of each liquid property on droplet size is usually established by actual test, however Delavan's field experience shows that these effects can be closely estimated from the following correction factors:

EFFECT OF LIQUID VISCOSITY

$D \propto \mu^{0.25}$

Where D = Mean droplet diameter, micrometers

μ = Absolute viscosity, centipoise

EFFECT OF LIQUID VISCOSITY

$D \propto \sigma^{0.33}$

Where σ = Surface tension, dynes/cm

Wear Resistance

The wear life of the internal parts (consumable parts), depends upon its corrosion and erosion resistant characteristics

Corrosion occurs when the liquid feed and wear parts are chemically incompatible.

Erosion results from the liquid feed with its abrasive solids physically removing the material.

Corrosion problems can be avoided if the chemical properties of the feed stock are known and the material of the consumable parts are designed to be compatible.

Erosion can be combated, but never fully overcome. The use of harder material, or special materials can reduce this problem.