Next generation mist eliminator selection in sulfuric acid plant drying, absorption towers

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There have never been a wider variety of alternatives to choose from to solve the mist elimination challenges that exist in the sulfuric acid drying and absorption towers. The specific needs of each plant depend on the type of plant and the priorities of its technical and operations management.

The principal types of mist eliminators employed to date have been the knitted wire mesh pad, the impaction-type candle, and the Brownian Diffusion-type candle. This article discusses the benefits and limitations of each type to assist managers in making informed decisions about the best technology for their specific needs.

Also introduced are three new product developments that offer significant improvements over current technology:

—Newly introduced DEMISTER® style 713 knitted wire mesh mist eliminator provides increased efficiency with low-pressure drop in drying towers.

—Newly introduced FLEXIFIBER® BD-LdP Brownian Diffusion candle mist eliminator provides reduced pressure drop with no loss in efficiency in absorber towers.

—Newly introduced FLEXIFIBER ICK-LF impaction candle mist eliminator provides increased service life with no loss in efficiency in drying and final absorber towers.

Types of equipment commonly considered

In current day sulfuric acid plants, most towers include one of the following types of mist eliminators.

TYPE OF MIST ELIMINATOR	COMMON MATERIALS
Traditional, all-metal DEMISTER® knitted wire mesh mist eliminator	Alloy 20 or Alloy 66 materials
Traditional all-plastic DEMISTER® knitted wire mesh mist eliminator	FEP (Teflon®) or ECTFE (Halar®) materials
High efficiency co-knit DEMISTER® knitted wire mesh mist eliminator	Combination of the above metal or plastic, interwoven with PTFE (Teflon®) or glass fiber
High efficiency FLEXIFIBER® impaction elements*	316L or Alloy 20 knitted mesh with PTFE (Teflon®) or glass fiber
High efficiency FLEXIFIBER® Brownian Diffusion elements	316L or Alloy 20 screens with glass fiber
These are most commonly cylindrical designs, often 30 inch (762 mm) OD by 66 inch (1676 mm) tall. Occasionally flat panel impaction elements are still used in drying towers as well.	

Table 1 — Mist Eliminator Types and Common Materials of Construction

Drying tower

Figure 1 provides typical efficiency vs. particle size comparison for the mist elimination equipment designs commonly used in drying towers. All commonly considered designs remove essentially 100 percent of the entrainment larger than 5 microns diameter, and the most efficient designs remove significant percentages of droplets below 1 micron diameter. Many plant operators recognize the advantages of high performance separation, and this is their primary mist eliminator selection priority.

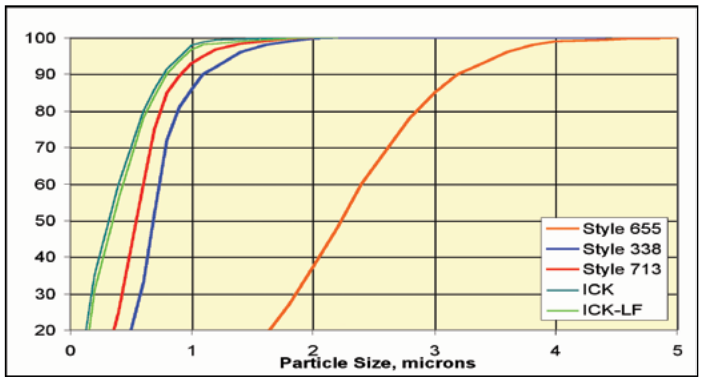

Figure 1 – Efficiency vs. Particle Size

Intermediate and final absorption towers

Figure 2 shows typical efficiencies for a standard design Brownian Diffusion fiberbed mist eliminator (baseline curve) compared with the recently developed FLEXIFIBER BD-LdP mist eliminators. Compared to the conventional design, the FLEXIFIBER BD-LdP mist eliminators have a high efficiency and at the same time have a significantly lower pressure drop as shown in Figure 3. This results in a reduction in operating costs, which is covered in more detail below.

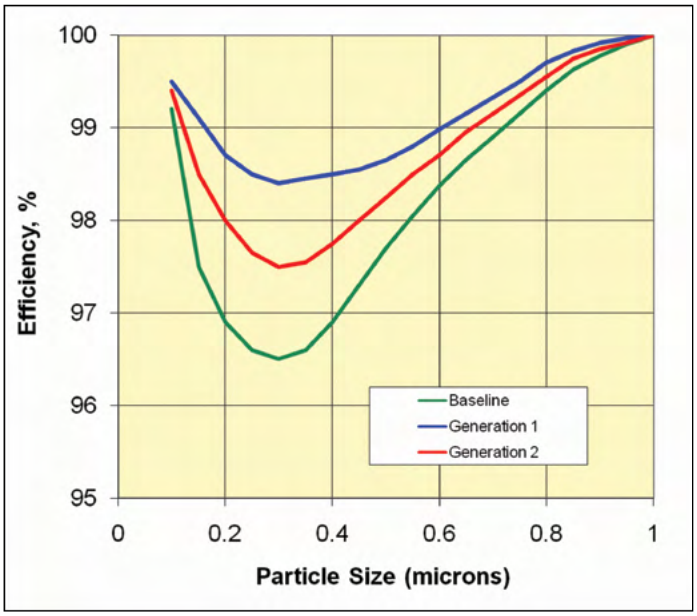

Figure 2 – Efficiency vs. Particle Size. Intermediate and Final Absorption Towers

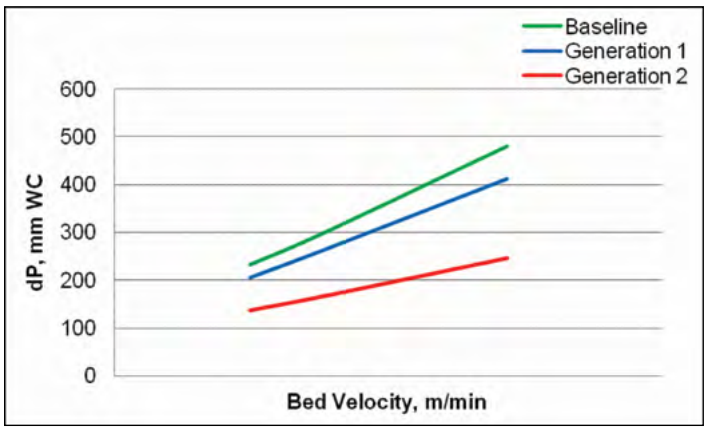

Figure 3. Pressure Drop. Baseline +Generations 1 and 2

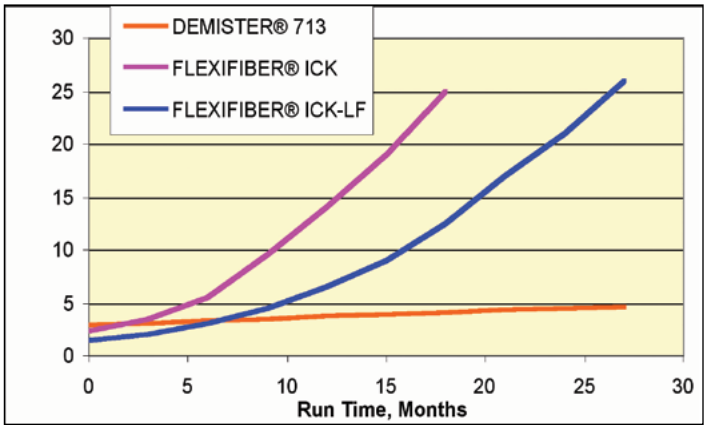

Figure 4 - Typical Pressure Buildup Curve

Operating costs

The primary operating cost consideration for mist elimination equipment is its pressure drop. Table 2 provides the clean pressure drops typical for commonly used equipment at the equipment's design capacity. Contrary to what you would expect, higher efficiency does not always require higher clean operating pressure drop.

Service life is another major factor in the annual cost, and mist eliminators that last for many years can save on the labor and equipment costs needed to remove and replace shorter service-life alternatives. Mist eliminators with longer service life also can generally be counted on to provide assurance that expensive downstream equipment will be protected through the full operating cycle. Figure 4 shows some typical run lengths for some dry tower mist eliminator designs. Table 3 gives some relative costs for the different equipment options. Proper selection always involves a balance between equipment costs, operating costs and service life.

Product	Koch-Glitsch Style	Clean Pressure in. WC	mm WC
Traditional, all metal mesh	655	0.6	15
Traditional, all plastic mesh	255	0.65	17
High Efficiency, metal mesh	338	2.9	75
High Efficiency, plastic mesh	339	3.0	76
Highest Efficiency, metal mesh	713	2.9	75
Impaction Candle	ICK	2.75	70
Impaction Candle – Low Fouling	ICK-LF	1.5	37
Brownian Diffusion Candle	BD	10	250
Brownian Diffusion Candle – Low Pressure Drop	Bd-LdP	8	200

Table 2 – Mist Eliminator Types and Clean Pressure Drop

Internals	Material	Relative Cost
Traditional DEMISTER® pad	Alloy 20	1.0
Traditional DEMISTER® pad	Teflon®	2.0
Traditional DEMISTER® pad	Alloy 66	1.5
DEMISTER® pad Style 338	Alloy 66	1.75
DEMISTER® pad Style 713	Alloy 66	1.75
FLEXIFIBER® candles Style ICK	Alloy 20	3.5
FLEXIFIBER® candles Style ICK-LF	Alloy 20	4.0

Table 3 – Mist Eliminators and Relative Cost

Research and Development at Koch-Glitsch, LP

Koch-Glitsch, LP maintains a fully equipped research and development facility at its headquarters in Wichita, Kansas. These two test towers are devoted to the research and development of new mist eliminator designs. The latest FLEXIFIBER BD-LdP low-pressure drop designs came from test work performed in these towers.

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