Dow
Liquid Separations

DOWEX OPTIPORE
Adsorbents

Fluidized Bed Properties of Dow Polymeric Adsorbents

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Today's competitive environment demands low operating costs for all processes, including VOC emissions control. A major cost of high air flow treatment systems is pressure drop. Fluidized bed systems offer low pressure drops and high VOC removal efficiency.

Polymeric adsorbents are perfect choices for fluidized bed adsorption systems.

- Spherical adsorbents
- Excellent abrasion resistance for long life
- Easily fluidized over a range of air flows
- Low pressure drops offer low operating costs
- Tough beads with high crush strengths

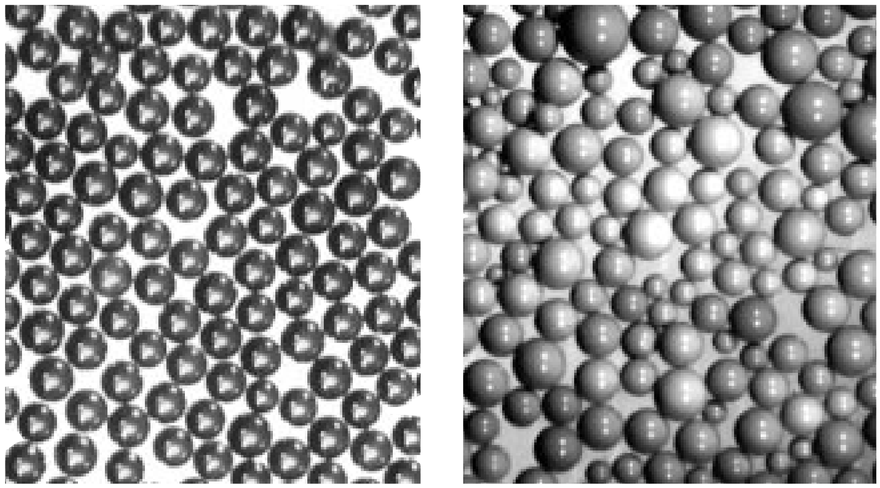
Spherical Adsorbents

Polymeric adsorbents are manufactured as round plastic balls. When they are fluidized there are no sharp edges or corners that can be ground off during use or destroy the equipment that holds them. Figure 1 shows a photomicrograph of two adsorbents that Dow manufactures. DOWEX* OPTIPORE* V493 adsorbent has a broader particle size distribution while XUS 43565.01 has a much more uniform particle size distribution.

Adsorbent Strength

Polymeric adsorbents have excellent crush strength to resist abrasion.

Figure 1. Photomicrographs of XUS 43565.01 and DOWEX OPTIPORE V493 Polymeric Adsorbents.



Crush strength is measured as the weight in grams required to crush an individual bead. Table 1 summarizes the crush strengths of several representative adsorbents.

Attrition resistance is another important measure of adsorbent strength. When ASTM Method D 5159-92, "Standard Test Method for Dusting of Granular Activated Carbon", is applied to polymeric adsorbents, the dust attrition, DA, is so low that it is statistically insignificant.

Polymeric adsorbents have been proven to have low attrition in field use. Customers who continuously operate fluidized bed adsorption systems report adsorbent replacement of less than 5% per year.

Adsorbent Fluidization and Pressure Drop

The objective of system designers is to effectively treat the contaminated air with the lowest pressure drop possible in order to minimize operating costs. Potential limits are the adsorption rates for the VOCs and air flows that are so high, they carry the adsorbent out of the system. Polymeric adsorbents have excellent adsorption kinetics, requiring as little as 20 msec for complete VOC removal.

The fluidization properties of a particle depend on its shape, size and density. All the particles described here are spheres, so size and density are the primary variables. See Table 1.

Table 1. Crush Strength of various adsorbents.

Adsorbent	Particle Size	Density (g/cc)	Crush Strength (g/bead)
DOWEX OPTIPORE V493	840-300 µm	0.34	≥700
DOWEX OPTIPORE V502	1.5 mm	0.4	≥1000
XUS 43565.01	450 µm	0.5	≥1000
DOWEX OPTIPORE V323	840-300 µm	0.27	≥200

DOWEX OPTIPORE V323 adsorbent resin has the lowest density of the OPTIPORE family of adsorbents, so it is most easily expanded. A bed of V323 starts to expand at an air flow of 15 ft/min. Again owing to its low density, V323 has a low pressure drop when fluidized. Figure 2 shows the relationship between pressure drop and bed expansion at various air flow rates for a 3 inch deep bed.

DOWEX OPTIPORE V493 adsorbent has an intermediate density thus requiring a slightly higher pressure drop to fluidize the bed. Figure 3 shows that the pressure drop is very consistent, averaging 0.95 in H_2O in a 3 inch deep bed.

Bed depth also contributes to pressure drop. When pressure drop is expressed as inches of H_2O/ft bed depth, the following results are observed (See Table 2). Less pressure drop is contributed by the adsorbent when shallow bed depths are used.

Table 2. Pressure drop and bed depth for DOWEX OPTIPORE V493.

Bed Depth	ΔP	ΔP/ft bed depth
3 inch bed	0.94	3.76
6 inch bed	2.35	4.69
9 inch bed	3.67	4.89

DOWEX OPTIPORE V502 adsorbent resin has the largest particle size of the OPTIPORE family of adsorbents at 1.5 mm. This adsorbent requires more air flow to fluidize, beginning to expand at 40 ft/min. Figure 4 shows the relationship between the ΔP and bed expansion. Because of the lower bed expansion, V502 can be used at higher air flows and still be effectively contained in the bed. In addition, the larger particle size of V502 means screens with larger openings and lower ΔPs can be used, resulting in lower total pressure drop.

Figure 2. Fluidization of DOWEX OPTIPORE V323

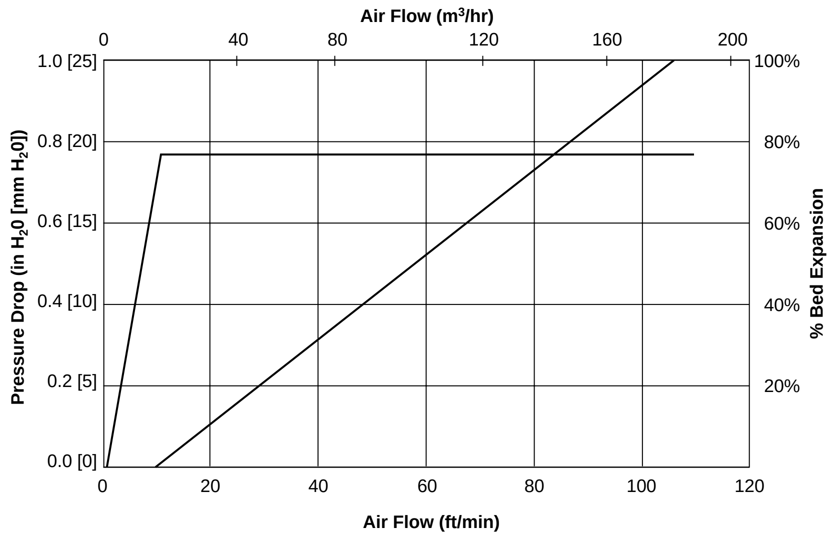


Figure 3. Fluidization of DOWEX OPTIPORE V493

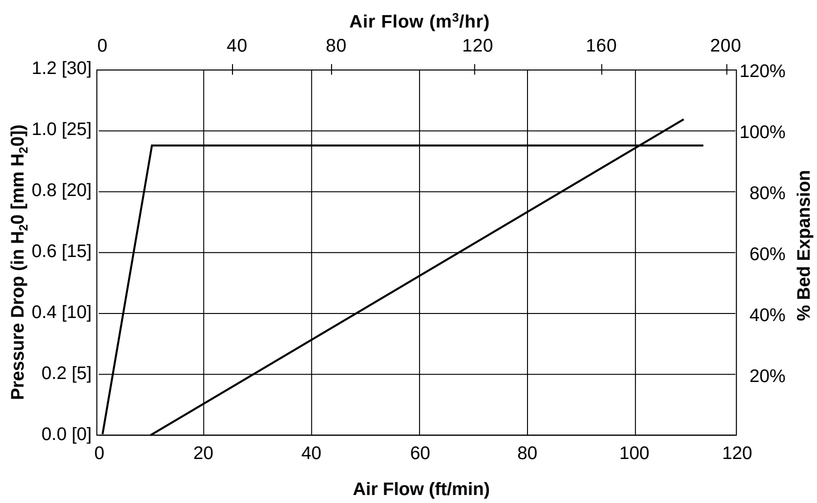
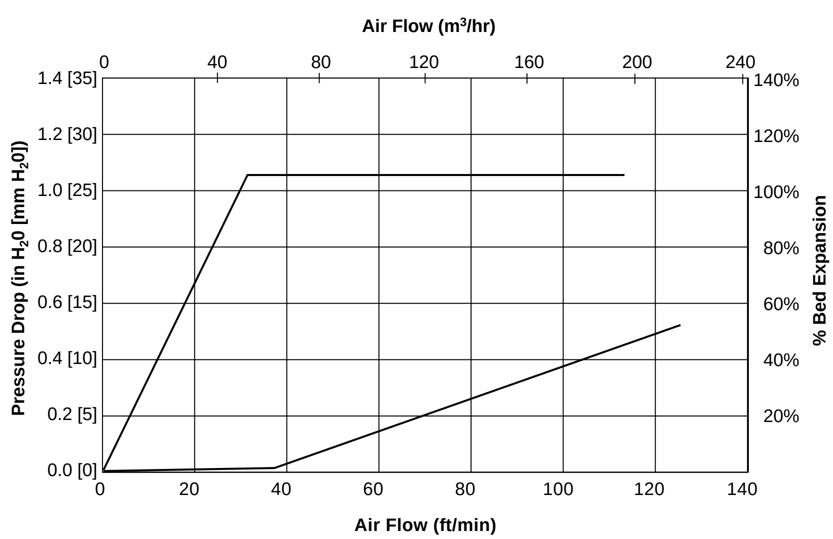


Figure 4. Fluidization of DOWEX OPTIPORE V502



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† Toll-free telephone number for the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom

Warning: Oxidizing agents such as nitric acid attack organic ion exchange resins under certain conditions. This could lead to anything from slight resin degradation to a violent exothermic reaction (explosion). Before using strong oxidizing agents, consult sources knowledgeable in handling such materials.

Published June 2002.

DOW*

Form No.177-01673-602QRP