

Sieving Analysis

Sieve analysis is a simple technique, commonly used for the determination of PSD and for the quantitative evaluation of the 'fineness' of powders.

Sieving is a mechanical size separation process. It is widely used in the food industry for separating fines from larger particles, and also for removing large solid particles from liquid streams prior to further treatment or disposal. Sieving is a gravity driven process. Usually a stack of sieves are used when fractions of various sizes are to be produced from a mixture of particle sizes.

To assist in the sifting of solids in a stack of sieves, sieve shakers are used. The shakers may be in the form of an eccentric drive that gives the screens a gyratory or oscillating motion, or it may take the form of a vibrator which gives the screens small amplitude high frequency up and down motion. When the sieves are inclined, the particles retained on a screen fall off at the lower end and are collected by a conveyor. Screening and particle size separation can thus be carried out automatically.

Standard Sieve Sizes

Sieves may be designated by the opening size, US-Sieve mesh or Tyler Sieve mesh. The Tyler mesh designations refer to the number of openings per inch, while the US-Sieve mesh designations is the metric equivalent. The latter has been adopted by the International Standards Organization. The two mesh designations have equivalent opening size although the sieve number designations are not exactly the same. Current sieve designations, unless specified, refer to the US-Sieve series. Size of particles are usually designated by the mesh size that retains particles that have passed through the next larger screen size. A clearer specification of particle size by mesh number would be to indicate by a plus sign before the mesh size that retains the particles and by a negative sign the mesh size that passed the particles. If a mixture of different sized particles are present, the designated particle size must be the weighted average of the particle sizes.

Table below shows US sieve mesh designations and the size of openings on the screen. A cumulative size distribution of powders can be made by sieving through a series of standard sieves and determining the mass fraction of particles retained on each screen. The particles are assumed to be spherical with a diameter equal to the mean of the sieve opening which passed the particles and that which retained the particles.

Table 13.5 Standard US-Sieve Sizes.

<i>US-Sieve Size (mesh)</i>	<i>Opening (mm)</i>	<i>US-Sieve Size (mesh)</i>	<i>Opening (mm)</i>
2.5	8.00	35	0.500
3	6.73	40	0.420
3.5	5.66	45	0.354
4	4.76	50	0.297
5	4.00	60	0.250
6	3.36	70	0.210
7	2.83	80	0.177
8	2.38	100	0.149
10	2.00	120	0.125
12	1.68	140	0.105
14	1.41	170	0.088
16	1.19	200	0.074
18	1.00	230	0.063
20	0.841	270	0.053
25	0.707	325	0.044
30	0.595	400	0.037

Source: Perry, R. H., Chilton, C. H., and Kirkpatrick, S. D. 1963. *Chemical Engineers Handbook*, 4th ed. McGraw-Hill Book Co., New York.