

The rate of flow of a given liquid under a constant head through a filter-mass of a finely divided solid will obviously be dependent upon the amount of space which is not occupied by the grains, *i. e.*, what is commonly called the "pore space." On first consideration, it would appear that the pore space would vary a good deal according to the size of the grains composing the mass, and the results of computation and experiment are an astonishing contradiction to this idea. The pore space is almost independent of the size of the grains, and the arrangement of the latter of chief importance. By considering a number of small spheres of uniform diameter packed as closely as possible in a given space, it is possible to arrive at a mathematical formula from which the pore space may readily be calculated.

Slichter¹ has shown that if the spheres are so arranged that their centers lie at the corners of a cube, the pore space will be 47.64 per cent; while if the centers of the spheres lie at the corners of a rhombohedron which permits the closest possible packing, the pore space is 25.95 per cent. Between these limits we may expect to find the porosities of all ordinary materials.

With actual materials, in the case where the grains are of approximately equal size, the pore space and also the diameter of the particles may be readily determined by counting a number of the grains, determining their combined weight and the specific gravity of the material; the total volume may be ascertained by adding the sand in small quantities to a cylinder, tapping gently with a flat-faced pestle until no further decrease in volume takes place. The results of this procedure on our sands are given in Table I.

Mesh screen	No of grains	Total wt. gm.	TABLE I			
			One grain gm. X 10 ³	Sp. gravity	Pore space per cent	Di. Mm.
30	300	0.0307	10.23	2.74	35.4	0.420
	300	0.0316	10.36			
40	400	0.0251	6.3	2.68	34.1	0.354
	400	0.0253	6.3			
50	400	0.0182	4.55	2.73	36.4	0.318
	500	0.0246	4.92			
60	800	0.0238	2.97	2.82	36.8	0.269
	600	0.0172	2.87			
80	800	0.0202	2.52	2.85	37.7	0.257
	600	0.0156	2.60			

The comparatively slight variation in pore space is worthy of note; and it may be added at this point that mixtures of small and large grains show a surprising similarity in their porosity to that of either taken alone. For all practical purposes, the pore

¹ *Loc. cit.*, p. 309.