

SEWAGE PURIFICATION BY ACTIVATED SLUDGE PROCESS

(Continued from page 302)

for the greater efficiency in view of the comparatively small gain.

Two things must be considered here. The first is that the data, listed against the 0.85 cu. ft. of air, were obtained in warm weather when the bacterial reaction of the sludge is exceptionally brisk; and, second, that the data were obtained upon the basis of a uniform rate of flow equivalent to the average rather than to the maximum flow of the day, to which a large storm flow will be added at times.

During the winters of 1915 and 1916 more than 2 cu. ft. of air per gallon were applied. The daily peak load will be 50 per cent. greater than the average flow; and the maximum storm flow will be 150 per cent. greater than the average.

Period of Contact

Air was applied to the sewage in the aeration tanks for periods ranging from 2.4 to 11 hours.

Data are given in the following table to show the relative effect of increasing periods of contact upon purification.

Table No. 2—Purification Obtained with Increasing Periods of Contact

Period of contact in Aeration Tank (Hrs.)	BACTERIA			SUSPENDED MATTER			ORGANIC MATTER		
	Number of per c.c. in the effluent	Per cent. Removed	P. P. M. in the effluent	Per cent. Removed	P. P. M. in the effluent	Per cent. Removed	P. P. M. in the effluent	Per cent. Removed	P. P. M. in the effluent
3	280,000	87	20	86	8	37	40	66	
4	68,000	95	16	92	10	42	36	71	
10	171,000	95	17	92	6	60	32	75	

The data given in this table show that the longer periods of contact removed the larger percentage of bacteria and the larger amounts of organic matter. The question has been raised here, also, as to whether the advantage gained is commensurate with the increased cost. By way of answer, it is important to note that sludge collects rapidly if the aeration period is short because the sludge does not become well digested. With three hours' aeration the plant may pick up as much sludge as 8 per cent. per day of the liquid volume of the aeration tanks whereas with 6 hours of aeration the plant will not pick up over 2 per cent.

The conditions of operation in the experiments were not quite typical of those which will prevail in the future municipal plant for the data given above were obtained with liquor flowing through the plant at a uniform rate representing the average flow of a day. Had the tank in service been subjected to the greatly increased flows which will strike the purification works with the daily peak loads

of the future city sewage, especially if accentuated by storm water, then the purification obtained would have fallen far below our standard.

Six hours of aeration for sewage, based on the average daily flow, must be provided to maintain our standard of purification.

Air Diffusers

Experiments were made with filtros plates, wood blocks, and perforated iron pipe grids as air diffusers. Owing to the fact that the sewage carried quantities of hair, grit, and other debris that passed through ½-in. bar screens, deposits gathered around the pipe grids and choked the holes. As these obstructions to a free discharge of air accumulated the pressures built up, the air bubbles grew large, and the efficiency of aeration decreased.

The sludge did not become aerated well enough to remove the colloidal matter. Therefore the samples of effluent were not analyzed.

Data obtained with wood plate and filtros diffusers are given in Table No. 3.

The data given in this third table show that the wood plate diffusers gave somewhat better purification than the filtros, the most noticeable difference being found in the removal of bacteria. It should be noted in this connection, however, that the numbers of bacteria in the sewage fed to the wood plates averaged only 1,200,000 per c.c. compared with 3,768,000 fed to the filtros.

The volume of air applied to the wood plates was somewhat larger than that applied to the filtros. Moreover, the surface area of the wood diffuser plates was 4.58 square feet whereas the area of the filtros plates was only 1.75 square feet.

Evidently the conditions were more favorable for aeration with the wood than with the filtros plates and may account for part of the increased efficiency. When the wood plates were new and clean the air bubbles were small. After the plates became coated with grit and debris the bubbles swelled to a larger size. Upon rubbing the surfaces of the plates with a stiff wood fibre scrubbing brush, to clean off the sediment, the bubbles immediately returned to their former small volume. But the pressure required to force the air through the plates built up after scrubbing until the plates "blew out" of their containers.

Sediment gathered on the surfaces of the filtros plates also and when these plates were scrubbed the bubbles decreased at once in size, but the pressure did not build up, and the filtros plates did not blow out of their containers.

Clean Air

The subject of aeration would not be treated completely without referring to the importance of cleaning the air before it is delivered to the filtros plates.

When the wind blows across the city, coal smoke loads the air on Jones Island with soot. This sifts through fine cloth, excelsior or cotton batting. If it enters the pores of the filtros plates, they choke, the pressure required to force air through increases and air diffusion becomes very bad.

A spray washer was installed to wash the air and it took out the dust—but loaded the compressed air with moisture which froze in and

Table No. 3—Data Obtained with Wood Plate and Filtros Air Diffusers

Kind of Diffuser Plate Used	No. of Cu. ft. air per Gall.	Period of Contact in Aeration Tank.	BACTERIA		SUSPENDED MATTER		ORGANIC NITROGEN		OXYGEN CONSUMED	
			Number per c.c. in the effl. 20° C.	Per cent. Removed	P. P. M. in the effluent	Per cent. Removed	P. P. M. in the effluent	Per cent. Removed	P. P. M. in the effluent	Per cent. Removed
Wood plate.	0.91	2.4	38,000	96	17	93	11	35	37	70
Filtros	0.85	2.7	272,000	92	29	90	8	34	46	65