

Estimate of rate of accumulation of sludge in stabilization ponds

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Abstract The purpose of this study was to establish a relationship between the population served by five water treatment plant for sewage ponds of stabilization with the volume of sludge accumulated over the years. Of course, these figures depend on the operating conditions of each system, especially in relation to systematic removal of sand in boxes of sand. There were different rates for different operating conditions, which were 9 to 51 liters of sludge per inhabitant per year.

Key words: sewage, pond, stabilization, sludge, rate, accumulation.

INTRODUCTION

All forms of biological sewage treatment or even by simple sedimentation create sludge. The sludge comes from residual water. The stabilization ponds are ways to treat sewage, which present operational simplicity, it does not demand continuous and routine removal of sludge, which differs from other forms of treatment of sewage, the sludge builds up inside it over the years. The sludge accumulated inside the ponds reduce the time of water detention and undermine the efficiency of treatment, besides being inconvenient because of the odor when it's carried to the surface. One way to estimate the volume of sludge that will be accumulated over time is the use of rates of accumulation of sludge.

The rates of accumulation that accumulate over time may be determined by the cumulative volume measured by bathymetry, and this is related to the population served during the time of operation. It is true that well at the same time the particles of solid matter accumulate in the ponds, which come from the raw sewage simply by separating solid-liquid mass or organic, according to the process of anaerobic digestion, is reduced in volume over time. Thus the data obtained are empirical, ie, they are not coupled to the mechanism of action of microorganisms. Another fact that focuses directly on reducing the volume of the lagoons is a fact there is no box of sand above the pond, or even with, otherwise proper maintenance, inevitably occur accumulation of sand along the sludge inside the pond. These rates can help the designers or even a team of operation to predict how much on how long you should promote the removal of sludge, so as not to hinder the efficiency of treatment.

METHODOLOGY

To determine the volume of sludge and sand accumulated in the ponds were made bathymetry. The bathymetry consisted in the adoption of long lines along the longitudinal and transverse, forming a grid of 5 meters per 5 meters. In each cross-axis was done to measure the mantle of sludge with the help of a dish, as Figure 1. This dish tied to a rope staggered emerged when stopped on the mantle of sludge consisted of a more denser mass. The reading could be done with the rope pulled slightly.



Figure 1-Dish being emerged in the pond



Figure 2-Boat being pulled along the axis

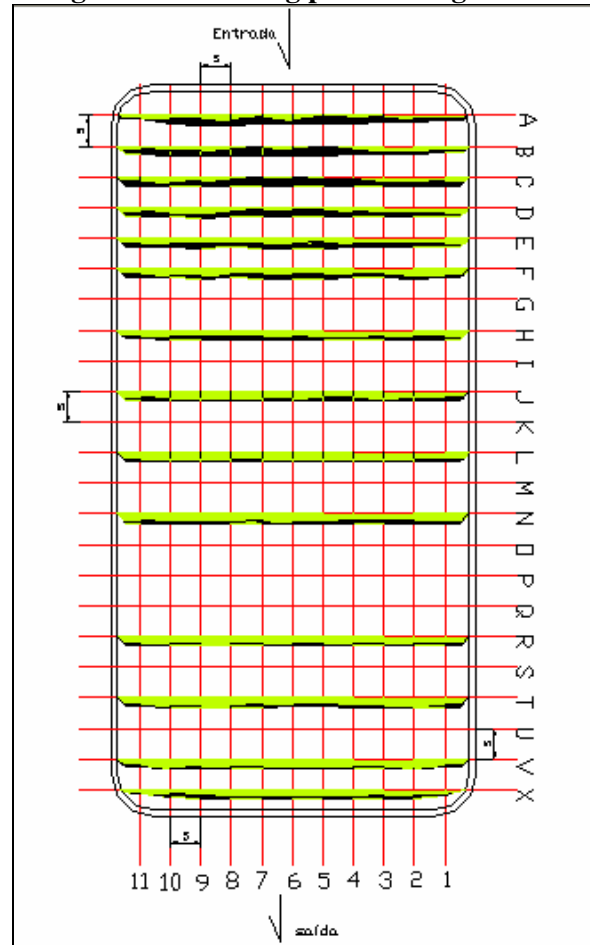


Figure 3 - longitudinal and transverse axes, and profiles of mantle of sludge

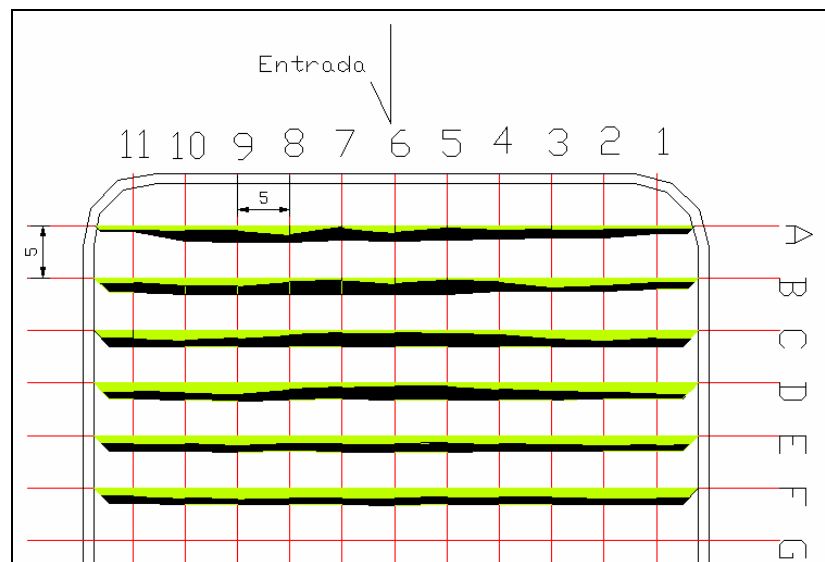


Figure 4 - Details of the profiles of sludge along the lines cross

With the measurements, rates of accumulation of sludge in the sludge liters per capita per year were estimated (L sludge / hab x years).

As the population changes over the years, for each pond an average of the number of people from every year was used. To estimate the population served by these lakes every year, we used an annual growth rate, corresponding to the population difference between the beginning and the final plan.

Basically for the existing ponds in Franca SP, the annual average of growth rate of 3.02% was considered and for all other small towns, 1.05%.

The ponds have related the following:

WTP pond Paulistano I: an optional cell, preceded railing and box of sand

WTP pond City Petrópolis: an optional cell, with no railing and box of sand

WTP pond Paulistano II: an anaerobic cell, an optional, with no railing and box of sand

WTP pond Jaborandi: an anaerobic cell, an optional, with a railing and with box of sand

WTP pond Icém: an anaerobic cell, an optional, with no railing and box of sand

When there is no box of sand, it is clear that beyond the sludge, sand builds up too, which should have been removed in the preliminary treatment.

Besides the reading of the height between the mantle of sludge and the net area, the total depth of the lake was measured to be introducing a rod with numerical scale to the bottom of the pond, trespassing the mantle of sludge.

With the measurements, vertical profiles were traces of sludge along the lines referenced in Auto CAD. The volume of a vertical profile and the other (two axles) has been obtained by multiplying the average between the two areas of vertical profiles by the distance between the axles.

Table 1 - Data considered to estimate rates of accumulation of sludge

	WTP City Petrópolis	WTP Paulistano I	WTP Paulistano II	WTP Jaborandi	WTP Icém
Year	Population (inhab)	Population (inhab)	Population (inhab)	Population (inhab)	Population (inhab)
1980	636				
1981	656	3365			
1982	676	3470			
1983	697	3578	4863		
1984	719	3689	5015		
1985	742	3804	5171		
1986	765	3922	5332		
1987	788	4045	5498		
1988	813	4171	5669		
1989	838	4300	5846		
1990	864	4434	6028	5041	
1991	891	4572	6216	5095	
1992	919	4715	6409	5149	
1993	948	4862	6609	5203	
1994	977	5013	6814	5259	
1995	1008	5169	7027	5314	
1996	1039	5330	7246	5371	
1997	1071	5496	7471	5428	

1998	1105	5667	7704	5485	
1999	1139	5844	7944	5544	5452
2000	1175	6026	8191	5602	5509
2001	1211	6213	8446	5662	5568
2002	1249	6407	8709	5722	5627
2003	1288	6606	8980	5783	5687
2004	1328	6812	9260	5844	5747
Tx. Population growth	3,02	3,02	3,02	1,05	1,05
Total years	24	23	21	14	5
average per years (inhab/y)	942	4896	6839	5433	5598
Volume of sludge in anaerobic pond	0	0	3700	0	1511
Rate of accumulation of sludge anaerobic pond - "L / inhab x year"			26		54
Volume of sludge in the facultative pond	1150	2164	1293	3192	556
Rate of accumulation of sludge facultative pond - "L / inhab x year"	51	19	9	42	20

CONCLUSIONS AND RECOMMENDATIONS

It seems that the rates of accumulation of sludge per person per year are diversified in line with the operational characteristics of each of the systems. This is because mixed with sludge, are also accumulated sand, taking the same space inside the pond. The better the system operated, with appropriate frequency of removal of sand in boxes of sand, the smaller the accumulated volume (sludge + sand), and consequently lower operational problems occur.