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DEPENDENCE OF TIME OF REGENERATION OF ACTIVE SILT IN AN AIRTANK FROM ITS DOSE

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Summary: Influence of dose of active silt is rotined on duration of its regeneration, insignificant influence of dose of active silt is set on the effect of cleaning of sewages.

Key words: Airtank, active silt, regeneration of active silt, speed of oxidization, duration of oxidization.

INTRODUCTION

The method of biological sewage treatment is based on ability of microorganisms to use various organic substances, containing in sewage, as the power supply in the course of ability to live. For maintenance of efficiency of process of biological oxidation in airtank it is necessary to submit air that is reached with the help airation. Necessary for a food of active silt, the oxygen dissolved in water, arrives from vials of air submitted in airtank.

Duration of regeneration of active silt is determined on a formula, *h*:

$$t_r = t_o - t_{at}, \tag{1}$$

where: t_0 is duration of oxidization of biocontaminations an active silt; t_{at} is duration of airation.

Duration of oxidization

$$t_o = \frac{L_{en} - L_{ex}}{R_i a_r (1-S)\rho_{ок}}, \tag{2}$$

where: L_{en} is an initial concentration of contaminations in sewer water, *mg/l*; L_{ex} is a concentration of contaminations in the cleared water, *mg/l*; R_i = 0,3 is a degree of recirculation of active silt; a_r is a dose of silt in a regenerator, *g/l*; S is an ash-content of silt: for city sewages S = 0,3; $\rho_{ок}$ is specific speed of oxidization in an airtank, *mg/g·h*.

The dose of silt in a regenerator is determined on the following formula, g/l:

$$a_r = a_i\left(\frac{1}{2R}+1\right), \tag{3}$$

where: a_i is a dose of silt in an airtank, *g/l*.

Specific speed of oxidization is in an airtank

$$\rho_{ок} = \frac{\rho_{\max} L_{ex} C_o}{(L_{ex} C_o + K_1 C_o + K_o L_{ex}) \cdot (1 + \varphi \cdot a_r)}, \quad (4)$$

where: $\rho_{\max}$ is high speed of oxidization: for city sewages $\rho_{\max}$ =85 *mg/g·h;* C_o =2 *mg/l* is a concentration of cut-in oxygen in an airtank; K_1 is a constant, characterizing properties of biocontaminations: for city sewages K_1 =33 *mg/l*; K_o is a constant, characterizing influence of oxygen: for city sewages K_o =0,625 *mg of* O_2*/l*; φ is a coefficient of inhibition of disintegration of active silt products: for city sewages φ =0,07 *l/g*.

Duration of airation:

$$t_{at} = \frac{2{,}5}{\sqrt{a_i}} \lg \frac{L_{en}}{L_{ex}}, \quad (5)$$

Duration of airation must be $\geq$ 2 hours [1].

OBJECTS AND PROBLEMS

Analysis of formulas (1) – (5) shows that duration of regeneration of active silt t_r depends on the dose of silt in an airtank, degree of water $L_{ex} / L_{en} (\tilde{N}_{\tilde{A}} / \tilde{N}_{\tilde{A}\hat{I}})$ and absolute value of initial concentration of contaminations treatment in sewer water $L_{en} (\tilde{N}_{\tilde{A}\hat{I}})$. The results of calculations are resulted on a fig. 1.

So, for example, at $\tilde{N}_{\tilde{A}\hat{I}}$ =500 *mg/l* with 4 *g/l* to 7 *g/l* conduces the increase of dose of silt to diminishing of duration of regeneration with 6,5 *h* to 4,2 *h* (diminishing on 2,3 *h*), while increase of dose of silt on a that size with 1 *g/l* to 4 *g/l* results in diminishing of time of regeneration with 19,6 *h* to 6,5 *h* (diminishing on 3,1 *h*). Besides it, the increase of initial concentration of contaminations $\tilde{N}_{\tilde{A}\hat{I}}$ conduces to some increase of duration of regeneration. So a_i =4 *g/l* increase $\tilde{N}_{\tilde{A}\hat{I}}$ from 200 to 500 *mg/l* is increased by time of regeneration with 6,5 *h* to 6,9 *h* (increase on 0,4 *h*).

The effect of cleaning of sewages settles accounts on a formula:

$$Ý = 100\% \frac{L_{en} - L_{ex}}{L_{en}} = (1 - \gamma) \cdot 100\%, \quad (6)$$

where: $\gamma = L_{ex} / L_{en}$ is a relative remaining concentration of contaminations.

The following correlation is in-process [2] got:

$$\gamma = \frac{1}{1 + \hat{E}_{i\hat{e}}\, t_{at}}, \tag{7}$$

where: K_{ok} is a constant of speed of biotoxidization of contaminations, s^{-1};

$$K_{ok} = \frac{\beta C_{\Pi O}}{\alpha C_{\Gamma O}}, \tag{8}$$

here β is a coefficient of transmission of mass, m/s; $C_{i\tilde{i}}$ is an initial concentration of oxygen in the bubble of air ($C_{i\tilde{i}}$ =0,3 *kg/m*^{3}); α = 0,4 - 0,6 *m* is a power coefficient, characterizing the power expenses of active silt on oxidization of contaminations.

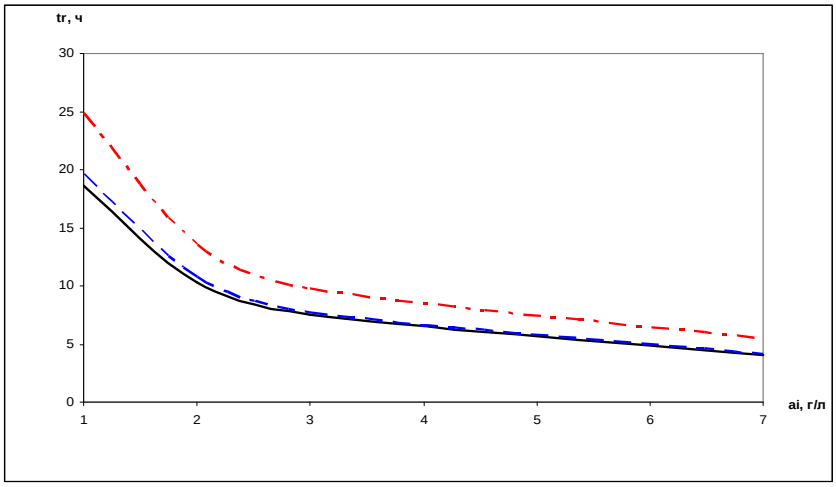

Fig. 1 The duration of regeneration diminishes with the increase of dose of silt.

However, increase of dose of silt more than 4 *g/l* is comparative poorly influences on duration of regeneration.

Expression looks like for a coefficient β.

For airation with shallow bubbles:

$$\beta = 2\sqrt{\frac{D\upsilon}{\pi d}}, \tag{9}$$

where: $D = 2 \cdot 10^{-9}\, m^2 / s$ is a coefficient of molecular diffusion; υ is speed of emerging of bubbles, m/s; d - in meters.

Expression for speed of emerging of bubbles is written down in a kind [3]:

$$\upsilon = 0{,}056 d^2 (1 - \rho_â / \rho) / \nu , \quad (10)$$

where: $\rho_â$ is air density, *kg/m*^{3}; ρ is a closeness of water, *kg/m*^{3}; ν is a coefficient of kinematics viscidity of water.

Results of calculations on formulas (6) - (10) at the turn-downs expense of sewages and their muddiness indicated higher show that, because duration of аэрации $t_{at} \geq 2h$, a cleaning effect does not depend on the dose of silt and makes about 98 %.

CONCLUSIONS

With the increase of dose of silt duration of his regeneration diminishes in an airtank. Thus increase of dose of silt more than 4 *g/l* is comparative poorly influences on duration of regeneration. The increase of initial concentration of contaminations of sewages conduces to the increase of duration of regeneration.

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МАЛО

ЗАВИСИМОСТЬ ВРЕМЕНИ РЕГЕНЕРАЦИИ АКТИВНОГО ИЛА ОТ ЕГО КОНЦЕНТРАЦИИ В АЭРОТЕНКЕ

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Аннотация: Исследовано влияние дозы активного ила на продолжительность его регенерации. Получена зависимость влияния дозы активного ила на эффективность очистки сточных вод.

Ключевые слова: аэротенк, активный ил, регенерация активного ила, скорость окисления.