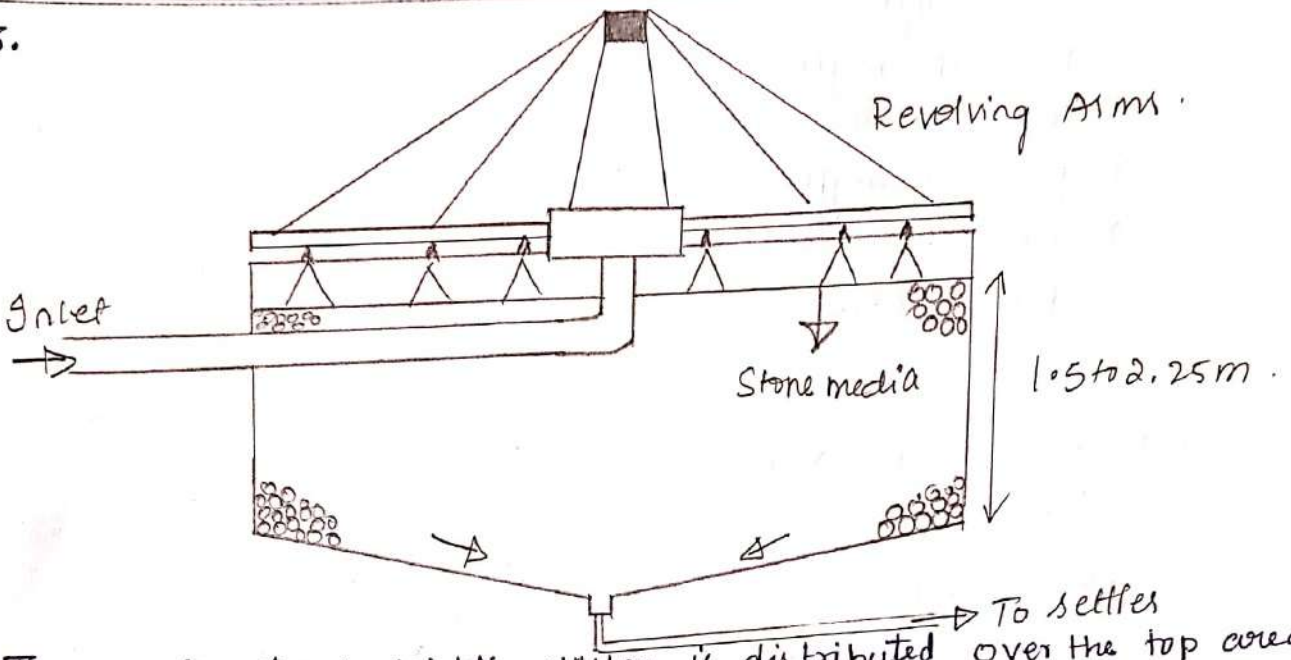
Municipal waste water Engineering

(18CV55)

IAT:03

3.



* The wastewater in trickling filter is distributed over the top area of a vessel containing non-submerged packing material.
* Air circulation in the void space, by either natural draft or blowers, provides oxygen for the microorganisms growing as an attached biofilm.
* During operation, the organic material present in the waste water is metabolised by the biomass attached to the medium. The biological slime grows in thickness as the organic matter abstracted from the flowing wastewater is synthesized into new cellular material.
* The thickness of the aerobic layer is limited by the depth of penetration of oxygen into the microbial layer.
* The micro-organisms near the medium face enter the endogenous phase as the substrate is metabolised before it can reach the micro-organisms near the medium face as a result of increased thickness of the slime layer and loose their ability to cling to the media surface. The liquid then washes the slime off the medium and a new slime layer starts to grow. This phenomenon of losing the slime layer is called sloughing.
* The sloughing off film and treated wastewater are collected by an Under drainage which also allows circulation of air through filter. The

collected liquid is passed to a settling tank used for solid-liquid seperation.

1. Given:- * $Q_s = 1200 m^3/s$
* $Y_s = 0 mg/l$
* $D_o = 9.2 mg/l$
* $Q_e = 80 m^3/s$
* $y_e = 250 mg/l$
* $D_o = 0$
* $k_d = 0.1/day$
* $f_s = 3.5$

$$D_{omix} = \frac{(9.2 \times 1200) + (0 \times 80)}{1200 + 80}$$

$$= 8.625 mg/l$$

∴ Initial Do deficit = $D_o = 9.2 - 8.625$

$$= 0.575 mg/l$$

5-day BOD of the mix is given by

$$y_5 = \frac{(0 \times 1200) + (250 \times 80)}{1200 + 80} = 15.625 mg/l$$

$$y_5 = L_o (1 - 10^{-kt})$$

$$15.625 = L_o (1 - 10^{-0.1 \times 5})$$

$$L_o = 22.85 mg/l$$

$$t_c = \frac{1}{k(f_s - 1)} \log_{10}\left[f_s \left[1 - (f_s - 1)\frac{D_o}{L_o}\right]\right]$$

$$= \frac{1}{0.1(3.5 - 1)} \log_{10}\left[3.5 \left[1 - (3.5 - 1)\frac{0.575}{22.85}\right]\right]$$

$$t_c = 2.063 \text{ days}$$

$$D_c = \frac{L_o}{f_s} (10)^{-kt_c}$$

$$= \frac{22.85}{3.5}(10)^{-0.1 \times 2.063}$$

$$D_C = 4.059 \text{ mg/l}$$

$$x_c = V \times t_c = 0.12 (2.063 \times 24 \times 60 \times 60) 10^{-3}$$

$$x_c = 21.39 \text{ km}$$

4.

⇒ Modification of activated sludge process.

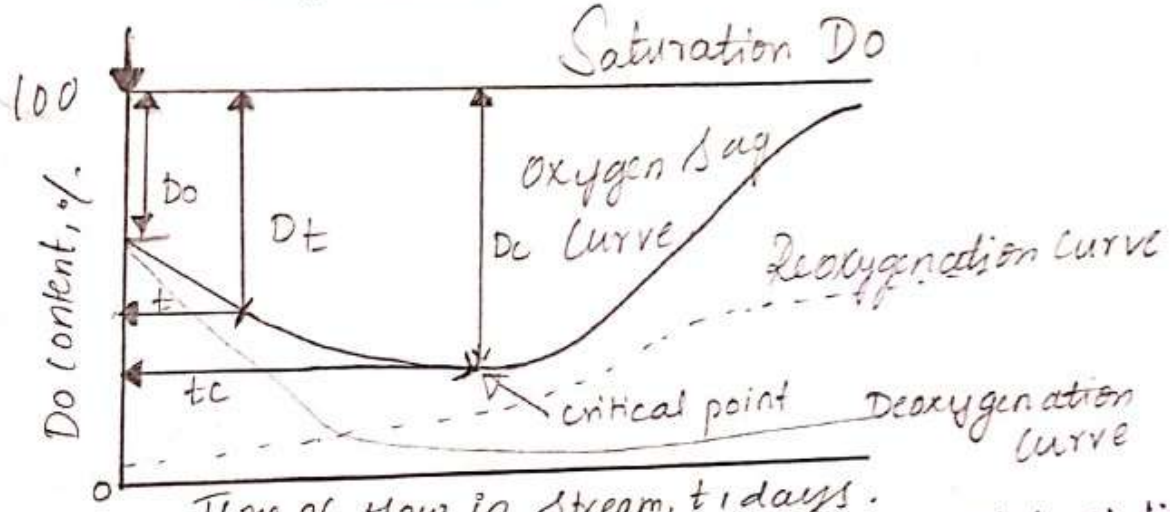
* Step aeration
* complete mix
* conventional
* tapered aeration
* contact stabilization
* pure oxygen system
* extended aeration.

⇒ Complete Mix Aeration:- In complete mix aeration the influent and the returned sludge are mixed and applied at several points along the length and width of the basin. The contents are mixed, and the mixed liquor suspended solids flows across the tank to the effluent channel. The oxygen demand and organic loading are uniform along the entire length of the basin.

⇒ Pure oxygen System:- Oxygen is diffused into covered aeration ta -nks. A portion of gas is wasted from the tank to reduce the concentration of carbon dioxide. The process is suitable for high-strength wastes where space may be limited. Special equipment for generation of oxygen is needed.

2. The automatic purification of natural waters is known as self Purification. The self purification of natural water system is a complex praces that involves physical, chemical and biological processes working simultaneously. The amount of dissolved oxygen (DO) in water is one of the most common used indicators of a river health.

⇒ Oxygen Sag Curve:-



The oxygen sag in the stream at any point of time during self purification proces is the difference blw saturation DO content and actual Do content. The amount of resultant oxygen deflect can be obtained by algebraically adding the deoxygenation and re-oxygenation curves. This curve is called as oxygen sag curve.

The saturation Do value for fresh water depends upon the temperature and total dissolved salts present in it. The value varies from 14.62 mg/L, 0°C to 7.63 mg/l at 30°C & lower Do at higher temperature.

Oxygen deficit, D = saturation Do - Actual Do

The Do in the stream may not be at saturation level & there may be initial oxygen deficit 'Do'. when the effluent with initial BOD load. Lo, is discharged in to stream, the Do content of the stream starts depleting & the oxygen deficit (D) increases. The majos point in sag analysis is point of minimum. Do. The maximum (or) critical deficit (De) occurs at the inflexion points.

5.

⇒ Oxidation Ditche:-

The oxidation Ditche (OD) is a modified form of the activated sludge system. Oxidation diches are mechanical Secondary treatment systems which are tolerant of variations in hydraulic and organic loads. Treatment of waste water using an oxidation ditch is relatively similar to waste water treatment in a packaged plant. But the oxidation ditch replaces the aeration basin and provides better sludge treatment. The ODs ~~are~~ can be easily adjusted to meet most combination of incoming Sewage and effluent standards. This System achieves both high BOD reduction and some nutrient removal. The only pretreatment typically used in an oxidation ditch System is the bar screen. After passing through the bar screen, waste water flows directly into the oxidation ditch.

⇒ Anaerobic Sludge digestion:-

~~Aer~~ Anaerobic sludge digestion is the process by which micro-organism break down biodegradable material in the absence of oxygen. The end products of the treatment proces are effluent & sludge. The sludge may be primary (or) Secondary depending upon whether the treatment was primary or secondary. Sludge digestion involves the treatment of highly concentrated organic wastes in the absence of oxygen by anaerobic bacteria. The Stabilization of sludge by decomposing the organic matter under controlled anaerobic conditions is called sludge digestion.

They are further broken into 3 forms:-

* digested sludge
* Supernatant liquid
* Gases of decomposition.