

MID SEMESTOR EXAM

Attempt all questions:

Marks:20

ASSUME ANY MISSING DATA

1. A completely mixed activated sludge process is to be used to treat wastewater flow of 750 m³/hr having a soluble BOD₅ of 290 mg/l. The conc. of soluble BOD₅ escaping the treatment is 23 mg/l. The saturation constant =110 mg/l, endogeneous decay coeff is 0.07 day⁻¹, yield coeff is 0.6, max specific substrate utilization rate; k=5 day⁻¹ and the conc of MLVSS is 2150 mg/l. Density of air at 25⁰C= 1.185 kg/m³; Calculate:

- a) the mean cell residence time ----(1)
- b) the hydraulic retention time(1)
- c) the treatment efficiency and F/M ratio(1)
- d) the volume of aeration tank.....(1)
- e) mO₂ (in kg/day).....(2)

If air is supplied to the plant at 25⁰C and the oxygen transfer efficiency is 15%, BOD₅ is 72.5% of the ultimate BOD, calculate the volume of air supplied to the plant in m³/day. (4)

2. An electrostatic precipitator is used with standard air containing dust particles of 1.0 μm diameter is in the form of a cylinder 0.4 m diameter and 2.5 m long. The volumetric flow rate of air is 0.075m³/s. If the electric field strength is 1.5X10⁵ V/m and particle charge is 0.35 x 10⁻¹⁵ coulomb, compute the collection efficiency.

[Data: λ= 0.071 μm, μ_g= 1.81x10⁻⁵ kg/m-s] (5)

3. A chimney with a design stack height of 350 m is emitting SO₂ at a rate of 650 g/s on a sunny day with moderate wind speed (7m/s) at stack altitude; Find:
< ρ_{SO2} > (1000,0, 0, 350), < ρ_{SO2} > (1000,60,0,350), < ρ_{SO2} > (1000,60,25,350).

Data: A=0.286, B= 0.109, p= 0.986, α = 0.25 (5)

Find the effective stack height if stack diameter is 6 m, SO₂ exit velocity is 12 m/s, exit gas temperature is 140 ⁰C and ambient temp is 25 ⁰C.