



WATER POLLUTION AND ITS TREATMENT TECHNOLOGIES

PROBLEMS (I)

Problem 1.- In order to design the primary treatment of a wastewater treatment plant, several samples were taken from the sewer system every two hours for one day and analyzed in the laboratory. The results are given in the table below.

Q (m ³ ·s ⁻¹)	Suspended Solids (mg·L ⁻¹)	Settleable SS (mg·L ⁻¹)
0.59	36	8
0,29	98	18
0.27	240	44
0.41	302	60
0.81	298	64
0.95	276	54
1.04	266	52
1.08	220	42
1.16	188	34
1.18	174	32
1.03	102	22
0.79	56	16

In particular, the city is planning to install a new circular settling tank. For that, calculate the average flow rate in L·s⁻¹ and average concentration of suspended solids in mg·L⁻¹.

Problem 2.- Calculate the Theoretical Oxygen Demand (ThOD) of a wastewater containing 300 mg·L⁻¹ of a carbohydrate (CH₂O) and 50 mg·L⁻¹ of ammonium nitrogen. Express the result in mg O₂·L⁻¹.

If the temperature increased 5 °C, would the ThOD increase or decrease?

Problem 3.- A wastewater contains phenol, glucose, sulfur ion, methanol and a refractory pollutant (C₉H₁₄O). The concentrations are given in the table below.

Assuming that sulfur ion is completely oxidized to sulfate by microorganisms, calculate the Chemical Oxygen Demand (COD) and the 5-day Biological Oxygen Demand (BOD₅) at 20 °C. Express the results in mg O₂·L⁻¹.



Compound	Concentration ($\text{mg}\cdot\text{L}^{-1}$)
$\text{C}_6\text{H}_5\text{OH}$	40
$\text{C}_6\text{H}_{12}\text{O}_6$	350
S^{2-}	3
CH_3OH	50
$\text{C}_9\text{H}_{14}\text{O}$	100

DATA $k_{20^\circ\text{C}} = 0.23 \text{ d}^{-1}$

Problem 4.- The average flow rate of a small river during the dry season is $100 \text{ L}\cdot\text{s}^{-1}$. The BOD_5 of the effluent of a wastewater treatment plant is usually equal or below $20 \text{ mg O}_2\cdot\text{L}^{-1}$. The limit value of receiving water for the BDO_5 is of $4 \text{ mg O}_2\cdot\text{L}^{-1}$. How many inhabitants can this treatment plant serve, while ensuring that river water quality standards are met?

Suppose that the BOD_5 of the upriver water is null and that this river is not the source of drinking water for the inhabitants of this village. The wastewater generation rate is $400 \text{ L}\cdot\text{hab}^{-1}\cdot\text{d}^{-1}$.