Primary Settling

CEEG 340–Introduction to Environmental Engineering
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Primary Treatment

Evaluate the following primary tank with respect to retention time, overflow rate, and weir loading, using the typical values provided in Table 1.

Design data:

Flow = 0.150 $\frac{m^3}{s}$
Influent suspended solids = 280 mg/L
Sludge concentration = 6%
Removal Efficiency = 60%
Length (effective) = 40.0 m
Width = 10.0 m
Liquid depth = 2.0 m
Weir length = 75.0 m

Table 1: Typical values used to design primary sedimentation tanks (adapted from Introduction to Envrionmental Engineering, by Davis and Cornwell,)

Parameter	Range
Overflow Rate ($\frac{m^3}{day \times m^2}$)	30–50
Hydraulic Retention Time (h)	1.5–2.5
Weir loading ($\frac{m^3}{day \times m}$)	<375

(1) CHECK HRT

$$\theta = \frac{\forall}{Q} = \frac{40m \times 10m \times 2m}{0.15\ m^3/s} \times \frac{1h}{3600s} \; ; \quad \theta = 1.5h \checkmark$$

(2) CHECK OFR

$$OFR = \frac{Q}{A} = \frac{0.15\ m^3/s}{40m \times 10m} \times 86{,}400\ s/day \; ; \quad OFR = 32\ \frac{m^3}{m \cdot DAY} \checkmark$$

(3) CHECK WL

$$WL = \frac{Q}{\text{WEIR LENGTH}} = \frac{0.150\ m^3/s}{75m} \times 86400\ \frac{s}{DAY}$$

$$WL = 173\ \frac{m^3}{DAY\ m} \checkmark$$

TSS and VSS

A 50 mL aliquot (i.e., representative sample) of a raw wastewater sample was filtered through a glass fiber filter, and dried for one hour in an oven set at 105 degrees C. The weight of the aluminum pan + dry filter (with no sample) was 1.2345 g , The weight of the aluminum pan + dry filter + dry sample was 1.2462 g.

The sample was then ingnited in a muffle furnace set at 550 degress C. The weight of the aluminum pan + dry filter + ingnited sample was 1.2360.

1. Calculate total suspended solids (TSS) in mg/L.

$$TSS = \frac{(1.2462 - 1.2345)\,g}{0.05\,L} \times 1000\,mg/g$$

$$\boxed{TSS = 230\ mg/L}$$

$$FSS = \frac{(1.2360 - 1.2345)\,g}{0.05\,L} = 30\,mg/L$$

2. Calculate volatile suspended solids (VSS) in mg/L.

$$VSS = TSS - FSS$$

$$\boxed{VSS = 201\ mg/L}$$

3. Compare to typical TSS concentration in raw wastewater of 250 mg/L.

TSS CALCULATED IS TYPICAL.