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SUBJ	wastewater Engineering
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SECTION	A

ASSIGNMENT # 01

## Question - 1:

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### Hydraulic Retention Time (HRT):

The hydraulic retention time (HRT) is a measure of the average length of time that a soluble compound remains in a constructed bioreactor.

\* The volume of the aeration tank divided by the influent flow rate is  $\tau$ , the hydraulic retention time.

\* The formula which establish the hydraulic retention time of an municipal wastewater treatment plant is given:

$$\tau = \frac{(SRT)}{X_T} \left[ \frac{Y(S_0 - S)(1 + f_d k_d (SRT)) + X_{0,i}}{1 + k_d (SRT)} \right]$$

→  $\tau$  = Hydraulic Retention time (d)

→ SRT = sedimentation Retention time (d)

→  $X_T$  = Total MLVSS in aeration tank  $\left[ \frac{g_{VSS}}{m^3} \right]$

→  $Y$  = Biomass yield

→  $S_0$  = influent soluble substrate concentration

→  $S$  = effluent soluble substrate concentration

→  $f_d$  = fraction of biomass

$k_d$  = endogeneous decay coefficient

(2)

$X_{0,i}$  = nbvss concentration in influent.

## Solids Retention Time (SRT)

Solid Retention time (SRT) is the average time the activated sludge solids are in the system. The SRT is an important design and operating parameter for the activated-sludge process and is usually expressed in days.

\* Solid retention is the the fraction of the wastewater spends in a treatment unit. It is a quantity of solids maintained in the reactor divided the quantity of solids coming out the reactor each day.

$$SRT = \frac{V \times C_d}{Q_{out} \times C_{out}}$$

$V$  = digester volume

$C_d$  = solid concentration

$Q_{out}$  = volume wasted

$C_{out}$  = solids concentration of the effluent.

# Question-2

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## 1) Anaerobic Reactor for decoupling SRT from HRT

Anaerobic reactor approaches that decouple SRT from HRT can be used, via separating and recirculating a portion of the microbes/solids, or immobilization the biomass. Such approaches allow a high SRT to be maintained, thus preventing washout of slow-growing anaerobes, yet allow reduction in reactor size

## 2) Recuperative Thickening: Decoupling SRT from HRT:

The level of methane production is only possible through co-digestion of dairy whey from local industries with municipal sludge and the utilization of a recuperative thickening loop to increase the solids retention time (SRT) of the primary digester.

\* Recuperative thickening recycles (4) active biomass and increase the SRT without decreasing the size of the digester. The average SRT for the primary digester was reported 13.4 days and would continue to decrease in foreseeable future as high strength dairy whey loadings increased.

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Question-3 :

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Advantages of decoupling SRT from HRT :

\* By decoupling SRT from HRT, the liquid wastewater can be processed by the average volumetric flow rate.

\* Separating SRT from HRT by immobilization the biomass

on surface has advantage over the traditional process of

separating liquid from the biomass in settling tank.

(5)

\* SRT is generally kept higher than HRT to take full use of adaptability of bacteria for biodegradable process