ENVE 301
2012-2013
PS # 2 – Reactors

Assist Prof. Bilge Alpaslan Kocamemi

Question 1 :

The contents of a tanker truck carrying a liquid organic waste are spilled accidentally into a small lake. The resulting initial concentration of the waste in the lake is 100 mg/L. The volume of the lake is 10^5 m^3. A stream that flows into and out of the lake has a flowrate of 1000 m^3/day. If the organic waste in solution undergoes first-order photochemical decay with a k value of 0.005 d^{-1}, determine the time required for the concentration of the waste in the lake to be reduced to 5 % of the initial value.

Question 2:
Determine the volume of a CFSTR required to give a treatment efficiency of 95% for a substance that decay according to half – order kinetics with a rate constant of
0.05 $(mg/L)^{1/2}$.
The flow rate is steady at 300L/hr and the influent concentration is 150mg/L.

Question 3 :
Determine the volumes of two identical CFSTR reactors in series to provide the same degree of treatment for the conditions given in Example 1.

Question 4 :
A plug flow reactor (PFR) is to be used to carry out the reaction
$A \longrightarrow B$
The reaction is first order and the rate is characterized as $r_a=-kC_A$

Determine the steady-state eff. conc. as a function of t_R .

Question5 :

Determine the volume of a PFR to provide same degree of treatment for the conditions given Question 1.

Question6 :

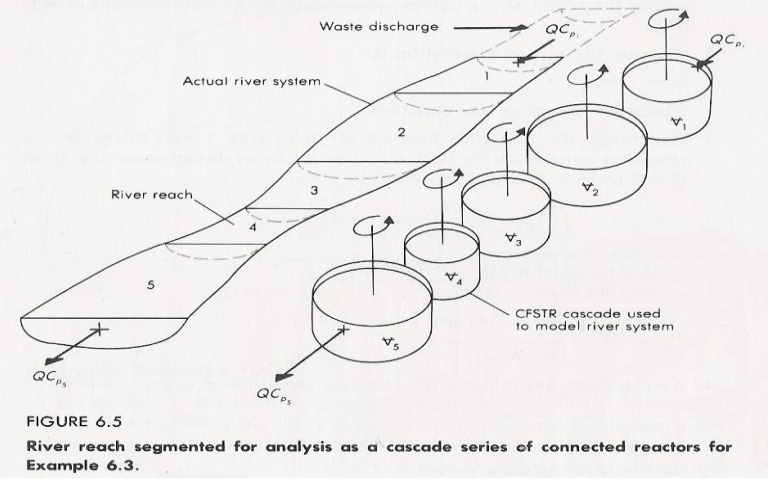

FIGURE 6.5
River reach segmented for analysis as a cascade series of connected reactors for Example 6.3.

V1=8.68 x 10 ^5 m3

V2=25.9x 10 ^5 m3

V3=17.28 x 10 ^5 m3

v4=8.64 x 10 ^5 m3

V5=25.92x 10 ^5 m3

The river reach shown has been divided into 5 segments based on measured velocities and depths. An industrial facility is planned just upstream of the 1st segment and it is necessary to estimate effect of ww discharge. A series of dye experiments have been run and each of the segments was found to behave as an approximate CFSTR. The pollutant is expected to disappear according to 1st order reaction. For the data given determine the steady-state pollutant con. in each segment.

$Q_{river} = 5m^3/sec$

$k = 0,2day^{-1}$

$C_0 = 30g/m^3$

$Q_{river} = 5m^3/sec$

$k = 0,2day^{-1}$

$C_0 = 30g/m^3$