Homework #3 - Solutions

Due: April 20, 2018 (Fri), 18:00 (35-517)

1. Read the following article discussing the ecology of *Vibrio cholerae* and briefly summarize the article. (in less than 0.5 page, strictly monitored for plagiarism).

   Cottingham, K.L.; Chiavelli, D.A.; Taylor R. K. Environmental microbe and human pathogen: the ecology and microbiology of *Vibrio cholerae*. *Frontiers in Ecology and the Environment*. Vol. 1, No. 2, 80-86, 2003.

   link:

   http://onlinelibrary.wiley.com/doi/10.1890/1540-9295(2003)001%5B0080:EMAHPT%5D2.0.CO;2/abstract

(15 points)

2. Select one from the types of pathogenic protozoa and helminthes in the box below. Attach a figure illustrating the life cycle of the pathogen you selected. Describe each stage of the life cycle (in Korean).

Pathogenic protozoa	Pathogenic helminthes
Giardia lamblia	*Hymenolepis nana* (a tapeworm species)
Entamoeba histolytica	*Diphyllobothrium latum* (a tapeworm species)
Malaria parasites (genus: *Plasmodium*)	

(15 points)

3. The following data are obtained in a laboratory completely-mixed batch reactor for a degradation reaction of compound A (CA: concentration of A). Answer the questions below.

Time (hr)	C_A (g/m^3)
0	30.0
0.5	12.0
1	7.5
2	4.3
4	2.3
8	1.2
16	0.6
32	0.3

C_A: concentration of A

1) Determine the reaction order and the reaction rate constant. (10 points)

2) A CSTR is receiving an influent containing 20.0 g/m^3 of A at a flow rate of 10 m^3/hr. To achieve 90% removal efficiency of A, what is the volume required for the CSTR being operated at a steady state? (10 points)

3. 하수도 시설기준에 의하여 주거지역만으로 이루어진 국내 어떤 도시의 하수처리 시설을 설계하고자 한다(즉, 공장폐수, 영업오수 및 관광오수 제외). 이 지역에는 분류식 관거(separate sewer)가 설치되어 있다. 도시의 15년전 인구수는 78000명, 현재 인구수는 95000명이며, 상수도계획 상의 1인1일최대급수량은 400 L/인-일이다. 다음 물음에 답하시오.

i) 계획목표년도를 20년으로 할 때, 등비급수법을 이용하여 이 도시의 계획인구수를 계산하시오. (5 points)

ii) 지하수량(I/I)을 1인1일최대오수량의 20%로 가정하여 계획1일최대오수량을 구하시오. (5 points)

iii) 계획1일평균오수량 및 계획시간최대오수량을 구하시오. 단, PF_{season} = 1.3, PF_{day} = 1.5. (5 points)

iv) 이 도시의 생활오수 오염부하량 원단위는 BOD 100 g/인-일, SS 80 g/인-일이다. 이 때, 하수처리시설의 계획오염부하량 및 계획유입수질을 계산하시오. (5 points)

4. Determine the settling velocity (in m/s) of a spherical particle with a density of 2.00×10^3 kg/m³ and a particle diameter of i) 0.5 mm and ii) 1.0 mm. Use the water density of 1.00×10^3 kg/m³ and the dynamic viscosity of 1.00×10^{-3} N-s/m². Assume the settling of both particles are in <u>transient region</u> of flow regime. You can choose any methods you would like, including manual calculation with trial-and-error and computer software such as Microsoft Excel or MATLAB. If you used computer software, attach the screenshot of the program. (30 points)