

Handout for Chapter 6 Water Quality Control

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“Water, water, everywhere nor any drop to drink.”

What you have to know after this course:

- ◆ Sketch flow diagrams of typical water and wastewater treatment system.
- ◆ Learn fundamental concepts of water and wastewater design.
- ◆ Define and understand the operational units in water and wastewater treatment such as coagulation, flocculation, disinfection, alkalinity, and activated sludge.
- ◆ Understand the technologies for hazardous waste treatment.

※Homework assignment #3

- (1) 請查出我國對下列物質在飲用水所允許之最大可濃度：大腸桿菌數、濁度、砷、鎘、總三氯甲烷、氯乙烯、硬度。
- (2) 課本第六章習題

This chapter includes four parts:

- (1) Standards for water quality, (2) water treatment technologies, (3) wastewater treatment technologies, and (4) hazardous waste and treatment technologies.

1. 法規標準：

- 中華民國飲用水法規分：_____、
_____、_____。

化學性標準：影響健康物質、可能影響健康物質、影響適飲性物質、有效餘氯含量(僅限加氯消毒之供水系統)、氫離子濃度指數等項。

- USA, The Safe Drinking Water Act (SDWA).

- Primary standards：MCLs (Maximum contaminant levels),
TT(_____).

(1) Chemical standards, Table 6.1, e.g., Asbestos (____), (2)Radionuclides,
_____, _____are often found in groundwater; _____,
_____ are surface water contaminants. The most important
radionuclide associated with drinking water is _____.

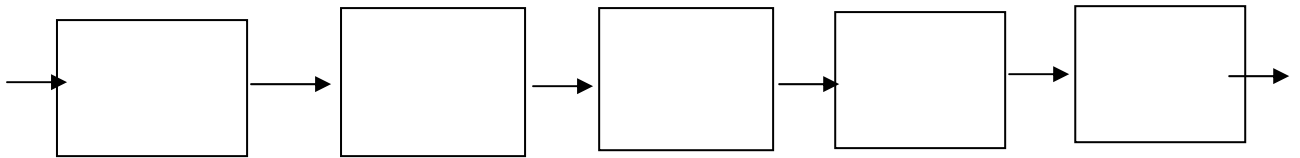
(3) Microbiological standards:_____.

- Secondary standards: unenforceable guidelines based on both aesthetics
such as _____, _____, and _____ of drinking water and

_____ such as corrosivity and hardness.

MCLGs (Maximum contaminant level goals): MCLGs for carcinogens are generally set to _____.

2. Water treatment systems



- Coagulation/Flocculation : destabilize colloidal particles/ attract colloidal particles.

Chemicals: alum (_____)、 _____ 、 _____

- Sedimentation and Filtration

- Disinfection :

Chlorination : _____ 、 _____ 、 _____

Free available chlorine (_____) : _____ 、 _____

Combined available residual chlorine (_____) : _____ 、 _____

DBPs (_____):

- **Hardness** :

Definition:

Unit:

Total hardness: CH(_____) + NCH(_____)

- **Alkalinity** :

Definition:

- Softening :

Ion-exchange, lime-soda process : _____ , _____

- Desalination :

Distillation process, Reverse Osmosis (RO)

3. Wastewater Treatment systems

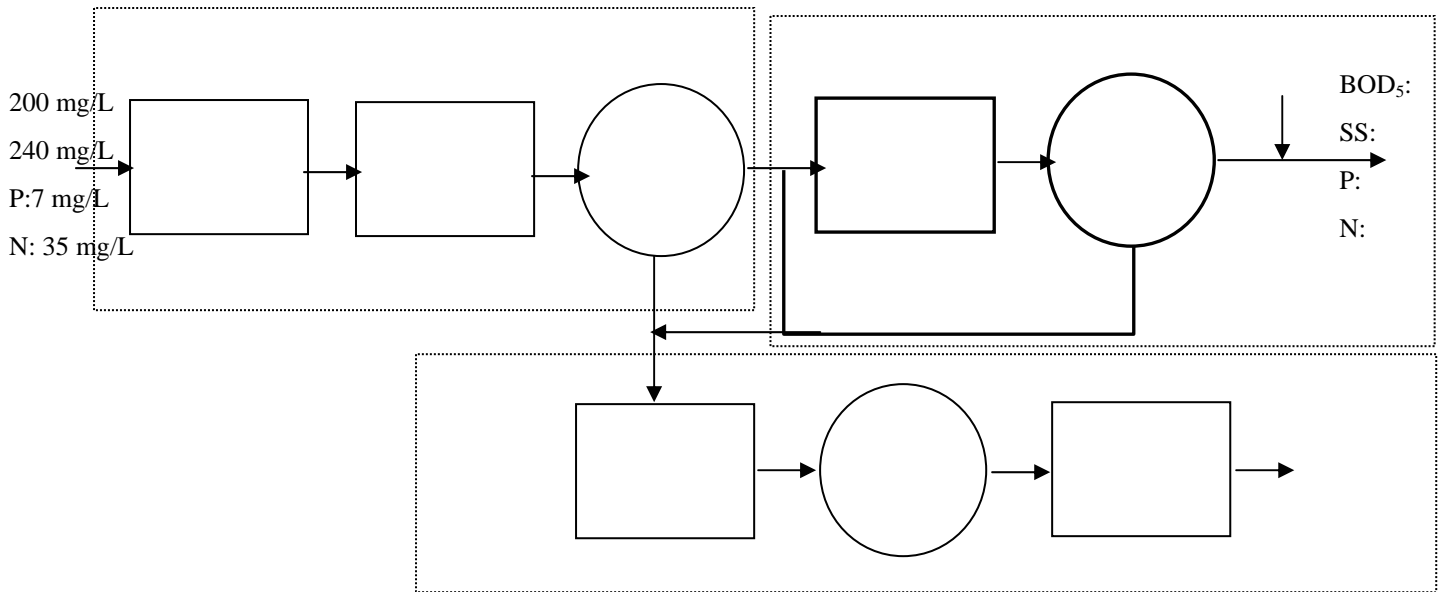
- 家庭污水的組成 Table 6.6 (Page 288): BOD₅, SS, N, P.

- 污水處理之分級 : _____ 、 _____ 、 _____

(1) Primary treatment: BOD₅ removal efficiency _____ % ; SS removal eff. _____ %.

(2) Secondary treatment: BOD₅ removal eff. _____ % ; SS removal eff. _____ %.

■ 典型污水處理流程與去除效率：



■ 污水處理單元之設計（概論）

(1) Primary settling tank (_____)

設計參數：水力停留時間(_____)，溢流率(_____)，有效水深。

(2) 生物處理 (Biological treatment)：生物膜/非生物膜

i. Activated Sludge (_____)

設計參數：水力停留時間、污泥齡、F/M ratio

ii. Rotating Biological Contactor (RBC) (_____)

Diameter _____、圓盤底部的_____%與污水接觸

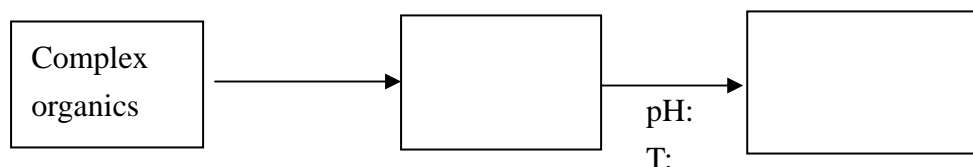
iii. Trickling Filters (_____)/Biological towers

Bed depth \leq _____、Diameters _____。

限制：1 _____ 2 _____ 3 _____

iv. Oxidation ponds/lagoons (_____): **Figure 6.13**

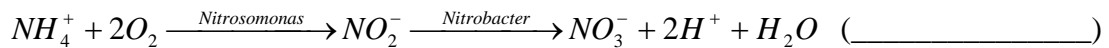
(3) Sludge Treatment (_____): Anaerobic digestion (_____)



4. Nutrient Removal (N, P): 30% removal efficient for N and P in a conventional wastewater treatment plant.

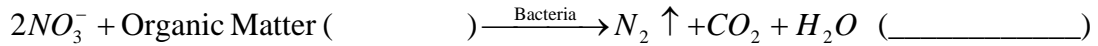
■ N Removal: Nitrification/Denitrification.

Nitrification:



does not take place until domestic wastewater is at least _____ days old.

Denitrification:



■ P Removal: Chemical Precipitation (_____), Coagulation (_____).

5. Hazardous wastes (有害廢棄物): Love canal, NY, late 1970s.

■ 定義: (1) _____ (2) _____ (3) _____ (4) _____。

有害事業廢棄物認定標準 (91.01.09) --有害特性認定之有害事業廢棄物種類如下:

一、毒性有害事業廢棄物:

二、溶出毒性事業廢棄物: 指事業所產生之廢棄物, 依事業廢棄物毒性特性溶出程序 (以下簡稱 TCLP) 分析超過法定值者。

三、腐蝕性事業廢棄物: 氫離子濃度指數 (pH 值) 大於或等於十二. 五, 或小於或等於二. 0; 或在攝氏溫度五十五度時對鋼 (中國國家標準鋼材 S 20 C) 之腐蝕速率每年超過六. 三五毫米者。

四、易燃性事業廢棄物: (一) 廢液閃火點小於攝氏溫度六十度者。(二)、(三)。

五、反應性事業廢棄物: 指事業產生之廢棄物, 具有下列性質之一者: (一) 常溫常壓下易產生爆炸者。(二) 與水混合會產生劇烈反應或爆炸之物質或其混合物。(三)(四)。

六、感染性事業廢棄物: 指醫療機構、醫事檢驗所、醫學研究單位、生物科技機構及其他事業於醫療、檢驗研究或製造過程中產生之廢棄物。

七、石棉及其製品廢棄物。

八、多氯聯苯有害事業廢棄物。

九、單一非鐵金屬有害廢料: 廢鉛、廢鎘、廢鉻。

■ 管理原則 (Figure 6.15)

■ Treatment Technologies: Table 6.9 (Page 309)

Chemical, biological, and physical wastewater treatment processes:

Chemical: Neutralization, chemical precipitation, Redox reaction, AOPs.

Physical: GAC adsorption

Thermal destruction process: Destruction and removal efficiency (DRE)

99.99 (four nines DRE) →

99.9999 (six nines DRE) →

Combustion process controlling factors: _____, _____, _____, _____

Fixation/stabilization techniques

■ Disposal: double-liner system, low permeability clay, monitoring systems for leachate.