Wastewater Treatment and Disposal

Chapter 9 - Nathanson

Summary

Raw sewage mostly pure water (99.9 percent water, 0.1 impurities)

Sea water is only 96.5 percent water

However, sewage contains biodegradable organics

Sea water mostly inorganic salts

Sewage ~ BOD 200 mg/L TSS 240 mg/L

Plant nutrients mostly 35 mg/L N

10 mg/L P

Coliform concentration ~ 10^9 per liter

Legislation and Standards

Several Federal Water Pollution Control Acts

(Clean Water Act) 1965-1987 85% BOD/TSS removal

Implemented by the National Pollution Discharge Elimination System (NPDES) administered by EPA - shifted focus from stream standards to pollutants in separate discharges.

Treatment efficiency

$$\text{efficiency} = \frac{P_{IN} - P_{OUT}}{P_{IN}} \cdot 100$$

P ~ pollutants mg/L

Pretreatment

p 290

Primary Treatment
Basic Level of Treatment (removes 60% suspended
35% of BOD

Screening and shredding
comminutor
Grit removal
Primary settling

Secondary Treatment
Biological (removes most of suspended solids,
85% of BOD and TSS)

Trickling Filters
Recirculation
Organic Load
Efficiency
Activated Sludge Treatment
Modifications of Activated Sludge Process
Pure Oxygen Aeration
Other Secondary Treatment Processes
Oxidation ponds
Disinfection - use of UV

Tertiary Treatment (Advanced)
Can remove 99% of pollutants
Drinking water quality

Includes:

Effluent Polishing

Uses a media

Phosphorus Removal

Uses Alum or aluminum sulfate (Al_2SO_4)

Ferric Chloride, $FeCl_3$, and lime, CaO

Also removes TSS

Nitrogen Removal

In form of organic nitrogen, ammonia, nitrate compounds

Called denitrification

Also use ammonia stripping

Land Treatment of Wastewater

On-site Wastewater Disposal

For lightly populated areas

Example: Septic Systems

Septic Tanks

Leaching Fields

Seepage Pits

Mounds

ET Systems

Sand Filters

Sludge Management

Sludge Characteristics and Treatment

Sludge Disposal (incineration, land application, marketing)