WASTE WATER TREATMENT PROCESSES

EFFORTS BY:-

BHAWNA KARGETI (2013212)

ISHA SHARMA (2013220)

KRITIKA SHARMA (2013226)

Water Hardness

- *Hard water is water that has high mineral content*
- *Contains a high concentration of calcium and magnesium ions.*
- *Generally not harmful to one's health.*
- *Can pose serious problems in industrial settings.*
- *Water softening is commonly used to reduce hard water's adverse effects.*

Biological Oxygen Demand

- Biological oxygen demand is a measure of the quantity of oxygen used by microorganisms (e.g., aerobic bacteria) in the oxidation of organic matter.
- BOD can be used as a gauge of the effectiveness of wastewater treatment plants.
- Higher the BOD values, the more difficult and costly are waste treatment and disposal practices.
- When the BOD of waste discharged into a stream is excessive, depletion of the stream's oxygen to satisfy this BOD causes problems in stream's ecology.

Chemical Oxygen Demand

- *It determines the amount of organic pollutants found in surface water (e.g. lakes and rivers) or wastewater.*
- *Oxidizing agents such as ceric sulphate, potassium iodate, and Potassium Dichromate have been used to determine COD.*
- *COD is expressed in mg/L, which indicates the mass of oxygen consumed per litre of solution.*
- *The COD test only requires 2-3 hours.*
- *The COD test can be used to measure the strength of wastes that are too toxic for the BOD test.*

WATER CHLORINATION

❖The process of adding chlorine to water as a method of water purification to make it fit for human consumption as drinking water.

❖Water that has been treated with chlorine is effective in preventing the spread of waterborne diseases.

CHLORINE is most widely used disinfectants provides protection against those bacteria that can cause typhoid , fever, dysentery , and cholera .

A possible sequence of events during chlorination would be:

- disruption of the cell wall barrier by reactions of chlorine with target sites on the cell surface
- release of vital cellular constituents from the cell
- termination of membrane-associated functions
- termination of cellular functions within the cell.

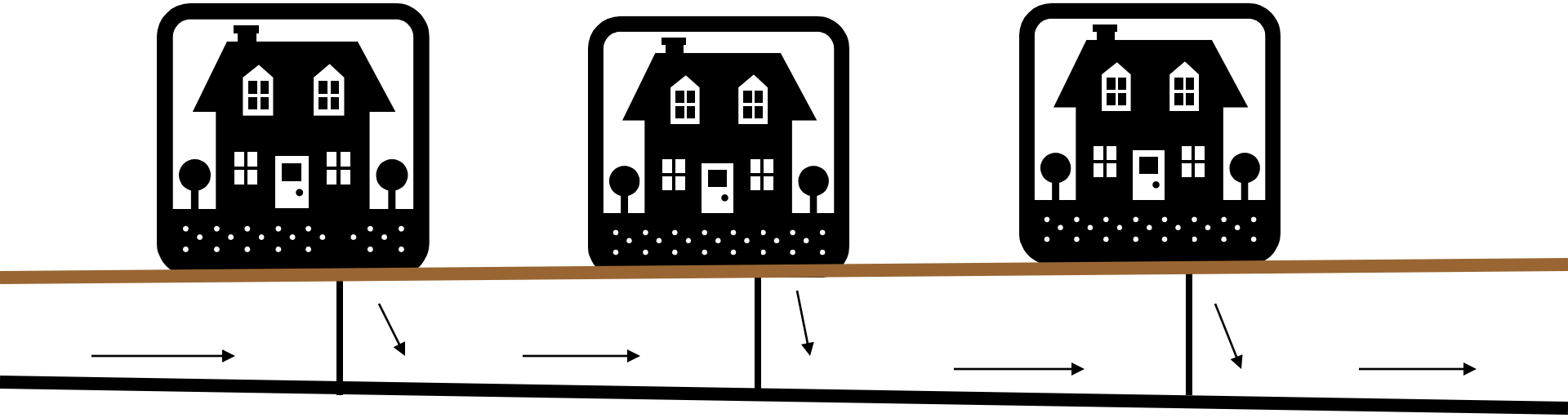
During the course of these events, the microorganism dies, meaning it is no longer capable of growing or causing disease.

Where does it all go!

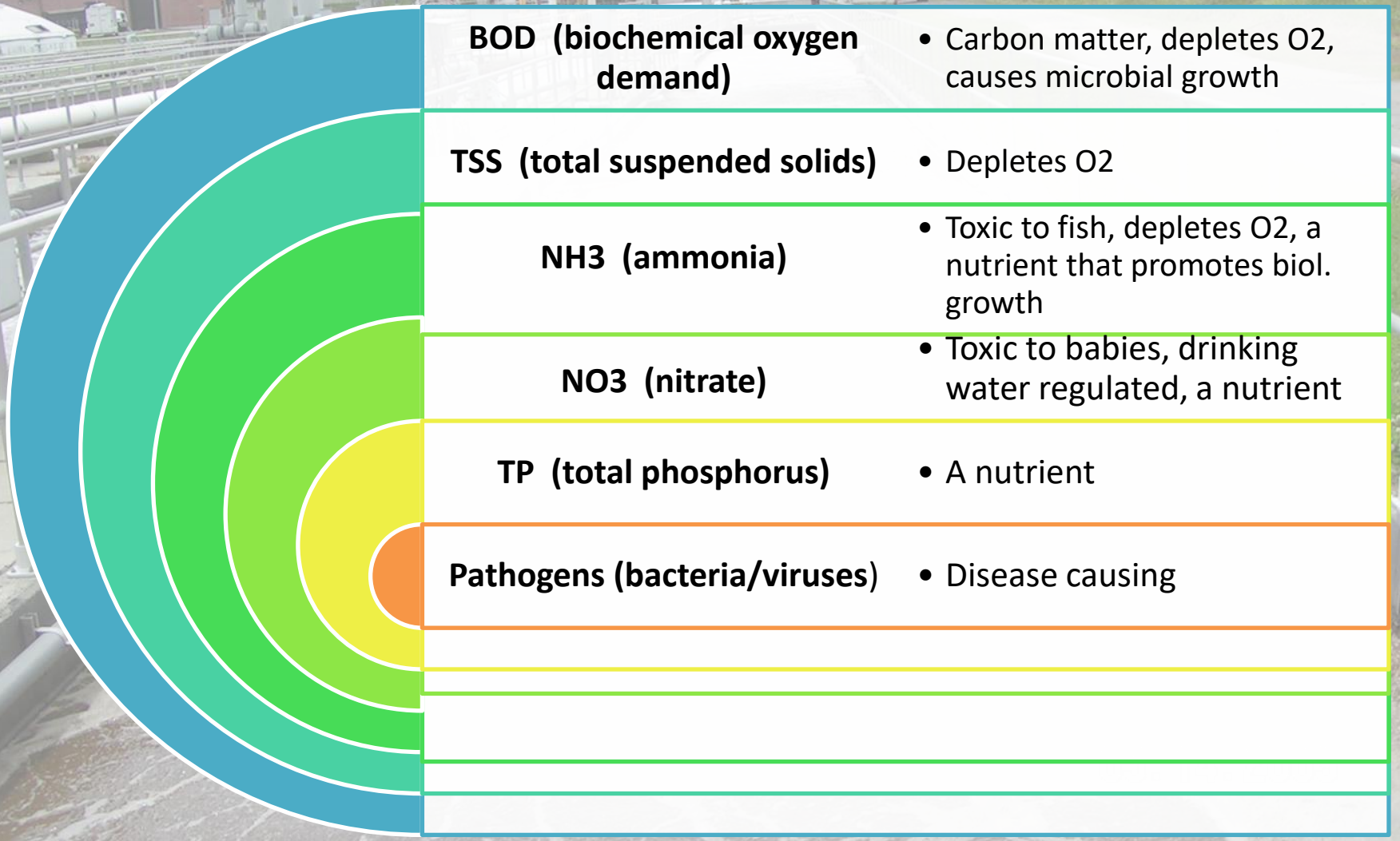
Where does the water from the washer go?

When you flush the toilet where does the contents go?

By gravity flow, the waste is on its way to your local wastewater treatment plant!



Treated Wastewater Effluent Contains…..



BOD (biochemical oxygen demand)	• Carbon matter, depletes O2, causes microbial growth
TSS (total suspended solids)	• Depletes O2
NH3 (ammonia)	• Toxic to fish, depletes O2, a nutrient that promotes biol. growth
NO3 (nitrate)	• Toxic to babies, drinking water regulated, a nutrient
TP (total phosphorus)	• A nutrient
Pathogens (bacteria/viruses)	• Disease causing

PRIMARY TREATMENT

Removal of large solids from the waste water via physical settling or filtration.

SCREENING

SEDIMENTATION

Screening

-- first step and involves the removal of large non-biodegradable and floating solids

--- Such as plastic, branches, rags, metals , tins , containers , wood, bones

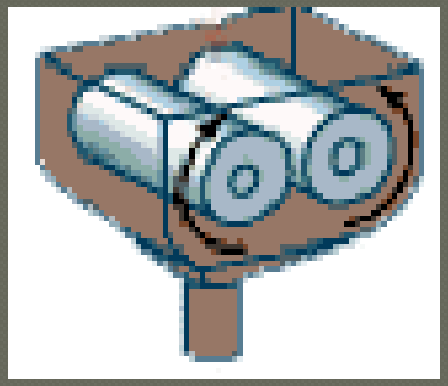
--Prevent the clogging and interference in further processes

--three types of screens– fine , medium , coarse screens are used.

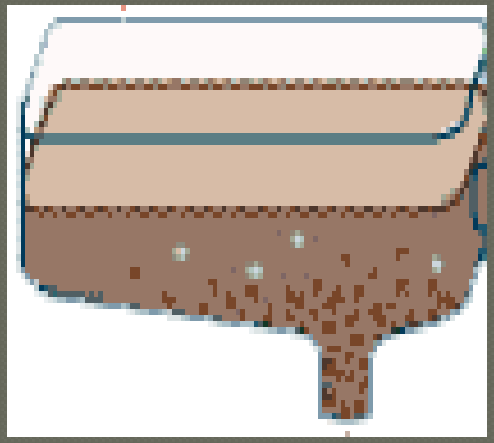
GRIT REMOVAL

Grit –includes sand , gravel, pebbles , cinder,and eggshell , bone chips , seeds, coffee grounds , and large organic particles in food waste

comminutor and **grit chamber**.



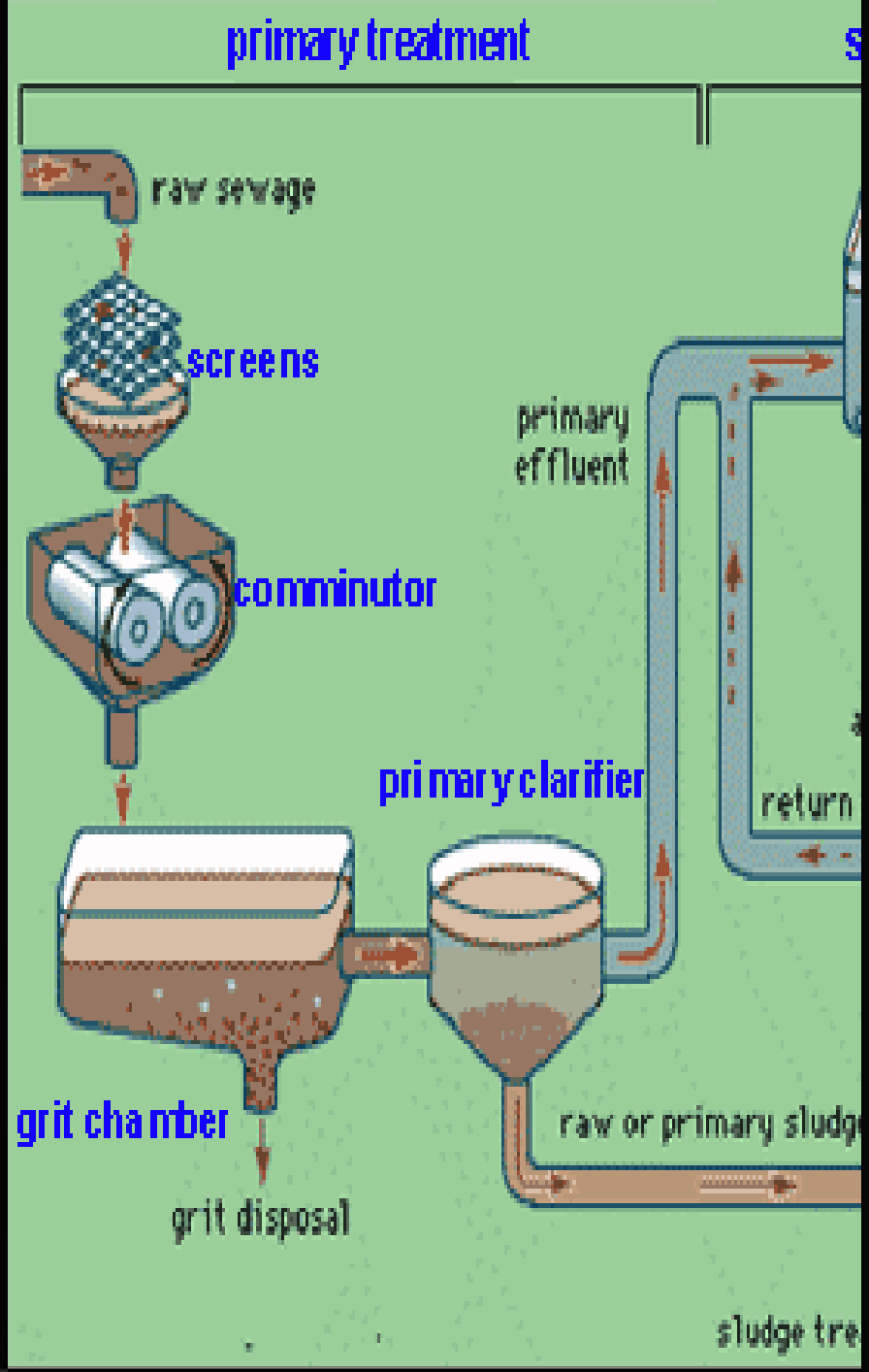
A **comminutor**, also known as the grinding pump, houses a rotating cutting screen. This cutting screen shreds any large chunks of organic matter in the wastewater into smaller pieces. This makes it easier for the microorganisms to use the organic matter as food .



A **grit chamber** allows pieces of rock, metal, bone, and even egg shells, which are denser than organic materials, to settle out of the waste stream. Removal of grit prevents damage to machinery through abrasion or clogging.

SEDIMENTATION

- physical settling of matter, due to its density, buoyancy, and the force of gravity.
- --Through sedimentation, the larger solids are removed in order to facilitate the efficiency of the further procedures and also to reduce the biological oxygen demand of the water.


primary treatment
raw sewage
screens
comminutor
primary clarifier
grit chamber
grit disposal
primary effluent
return
raw or primary sludge
sludge tre

SECONDARY TREATMENT

- *The second stage of wastewater treatment.*
- *Usually biological treatment is used to treat wastewater in this step.*
- *It involves the removal of biodegradable dissolved and colloidal organic matter using aerobic biological treatment processes.*
- *This step mainly includes:*

✓ ***Trickling filters***

✓ ***Activated sludge tanks***

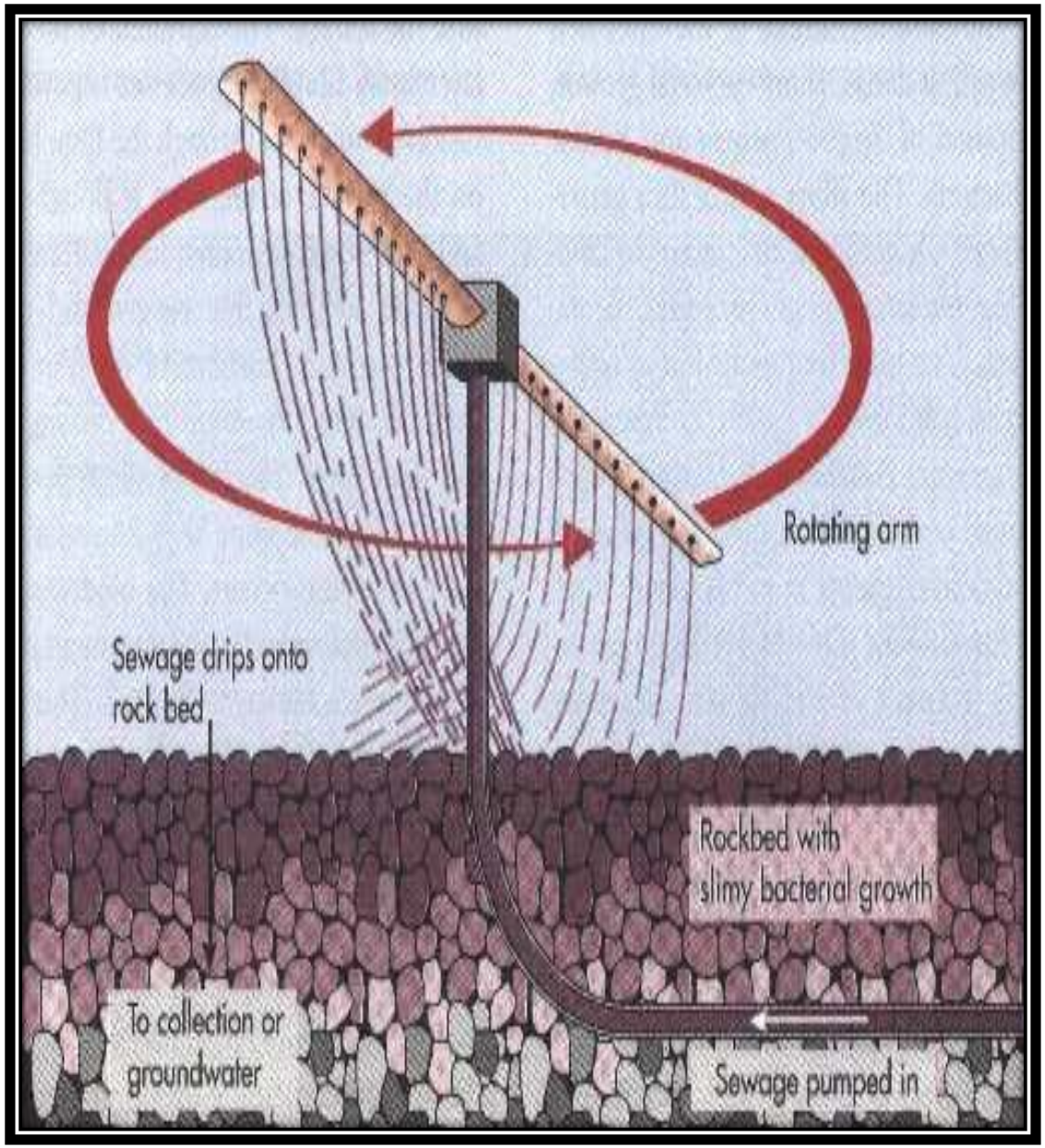
✓ ***Lagoons***

✓ ***Anaerobic digesters***

Trickling Filters

- A trickling filter consists of a bed of highly permeable media on whose surface microorganisms are developed as a slime layer.
- Wastewater is applied intermittently, or sometimes continuously, over the media.
- Organic matter in the wastewater diffuses into the film, where it is metabolized.
- Aerobic conditions are maintained by splashing, diffusion, and either by forced air flowing through the bed or natural convection of air if the filter medium is porous.
- This reduces the BOD by 70%.

TRICKLING FILTERS



Activated Sludge Tanks

- *Activated sludge process is a common method of aerobic wastewater treatment.*
- *Uses air and a biological floc composed of bacteria and protozoa.*
- *These tanks are large aeration tanks in which air is mixed to wastewater.*
- *The tanks soon develop a highly aerobic flocculent microbial growth, which continues to be nourished by the incoming waste.*

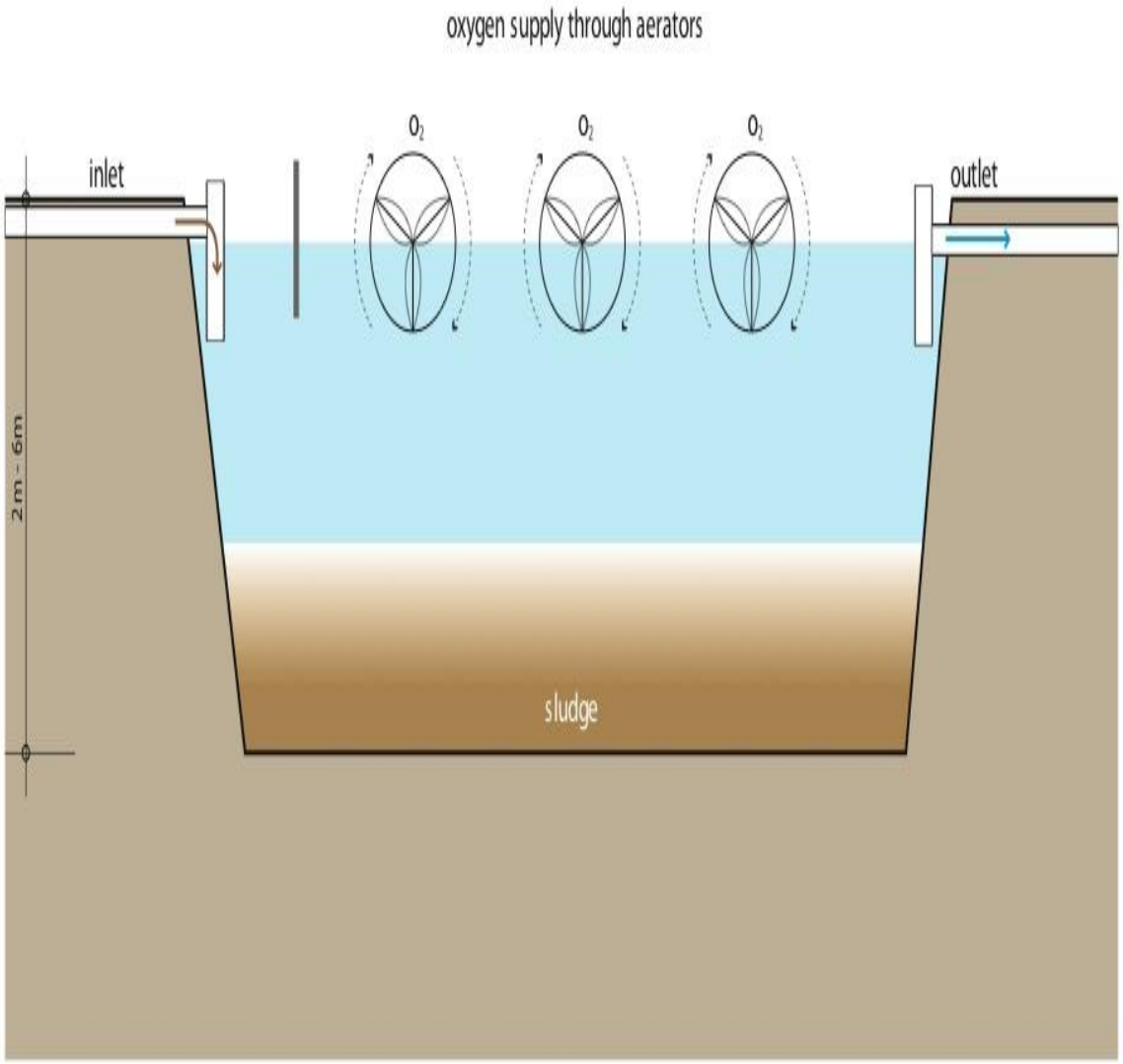
- *The supernatant is run off to undergo further treatment before discharge.*
- *Part of the active sludge is returned to the head of the aeration system to re-seed the new sewage entering the tank.*
- *The remaining sludge is further treated prior to disposal.*
- *If wastes are low in nitrogen, then some nitrogenous compounds can be added so as to decompose the wastes properly.*
- *In this BOD can be reduced by 90-95%.*

ACTIVATED SLUDGE TANKS

Lagoons

- An aerated lagoon is a treatment pond provided with artificial aeration to promote the biological oxidation of wastewaters.
- Water from Trickling Filters and Activated Sludge Tanks frequently are pumped into concrete tanks or man made ponds and lagoons.
- These are shallow to maintain an aerobic condition.
- In these further microbial degradation of remaining BOD occurs as well as additional settling of traces of solids.
- Water when clarified of solids is sufficiently low in BOD for approved discharge into lakes and rivers.

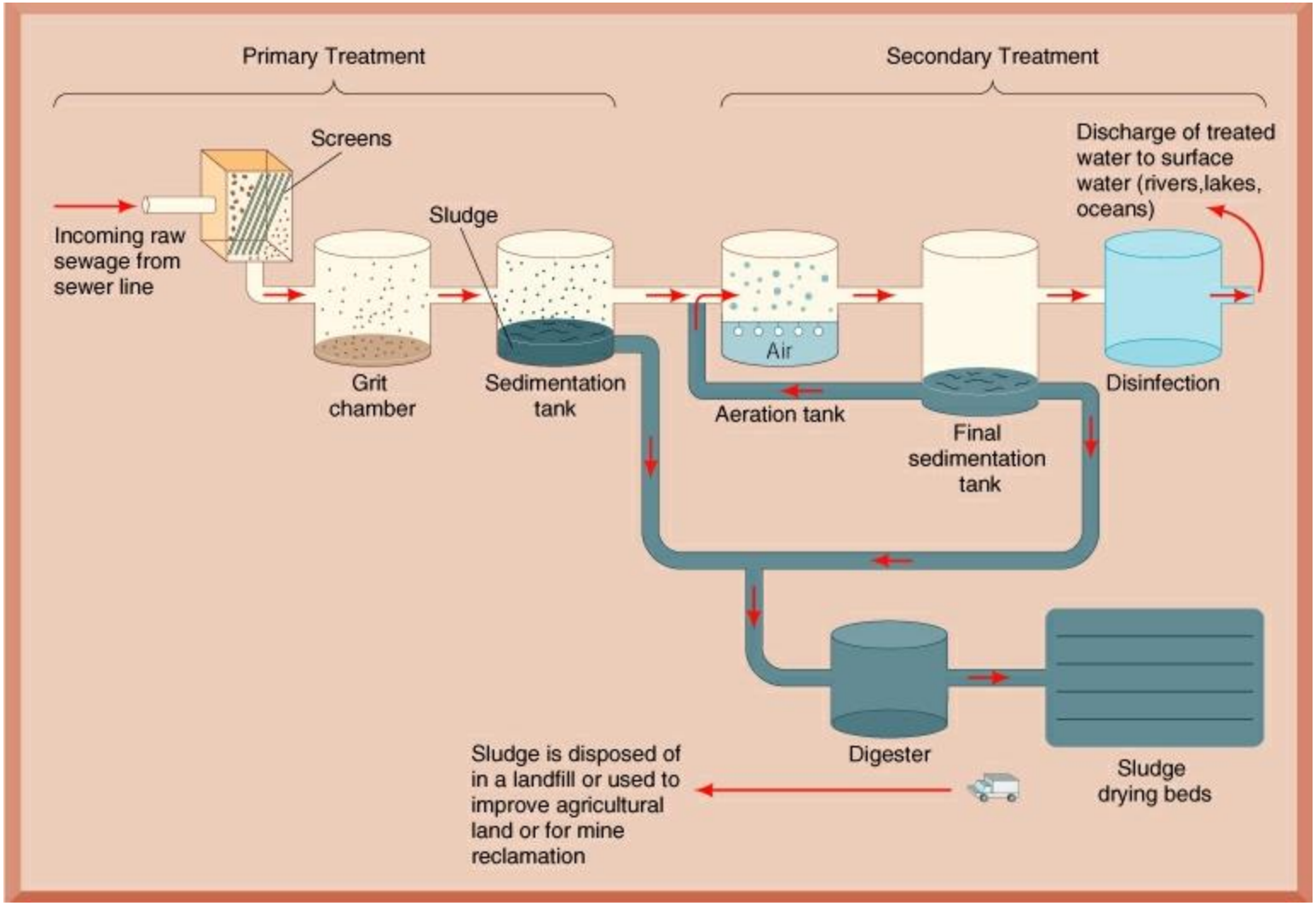
AERATED LAGOONS



ANAEROBIC DIGESTERS

- *Anaerobic digesters digest organic waste in a machine that limits access to oxygen, encouraging the generation of methane and carbon dioxide by microbes in the waste.*
- *This digester gas is then burned as fuel to make electricity.*
- *Digesters aren't widely used yet, but tend to be used for sewage sludge at sewage treatment plants and for animal waste on farms.*
- *Digesters are only marginally effective at reducing problems with odours, pathogens and greenhouse gas emissions.*

ANAEROBIC DIGESTERS


Primary Treatment
Secondary Treatment
Screens
Discharge of treated water to surface water (rivers,lakes, oceans)
Incoming raw sewage from sewer line
Sludge
Air
Grit chamber
Sedimentation tank
Aeration tank
Final sedimentation tank
Disinfection
Digester
Sludge drying beds
Sludge is disposed of in a landfill or used to improve agricultural land or for mine reclamation

TERTIARY TREATMENT

Remove disease-causing organisms from wastewater

3 different disinfection process

- **Chlorination**
- **UV light radiation**
- **Ozonation**

CHLORINATION

Most common

Two forms: 1. Liquid chlorine

2. Sodium hypochlorite tablets

Advantages: low cost & effective

Disadvantages: Chlorine residue could be harmful to environment

Chlorine dose

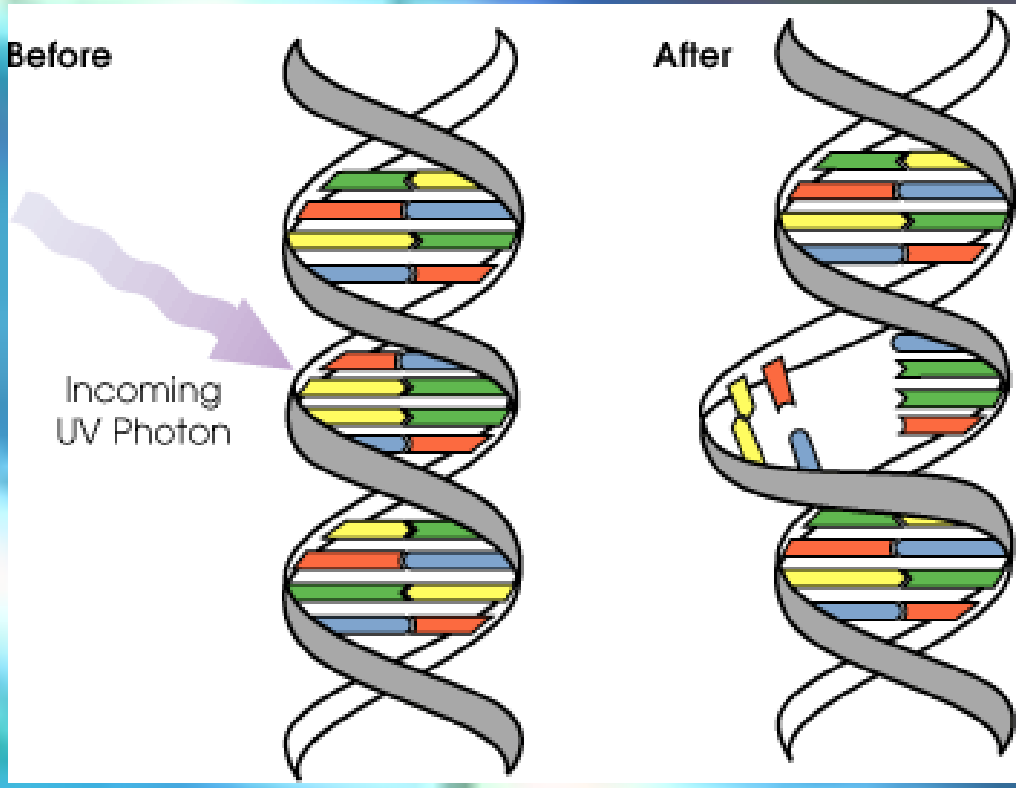
Table 1. Chlorine disinfection dose (in mg/L) design guidelines for onsite applications

Calcium hypochlorite	Septic tank effluent	Biological treatment effluent	Sand filter effluent
pH 6	35–50	15–30	2–10
pH 7	40–55	20–35	10–20
pH 8	50–65	30–45	20–35

Note: Contact time = 1 hour at average flow and temperature 20 °C. Increase contact time to 2 hours at 10 °C and 8 hours at 5 °C for comparable efficiency. Dose = mg/L as Cl. Doses assume typical chlorine demand and are conservative estimates based on fecal coliform data.

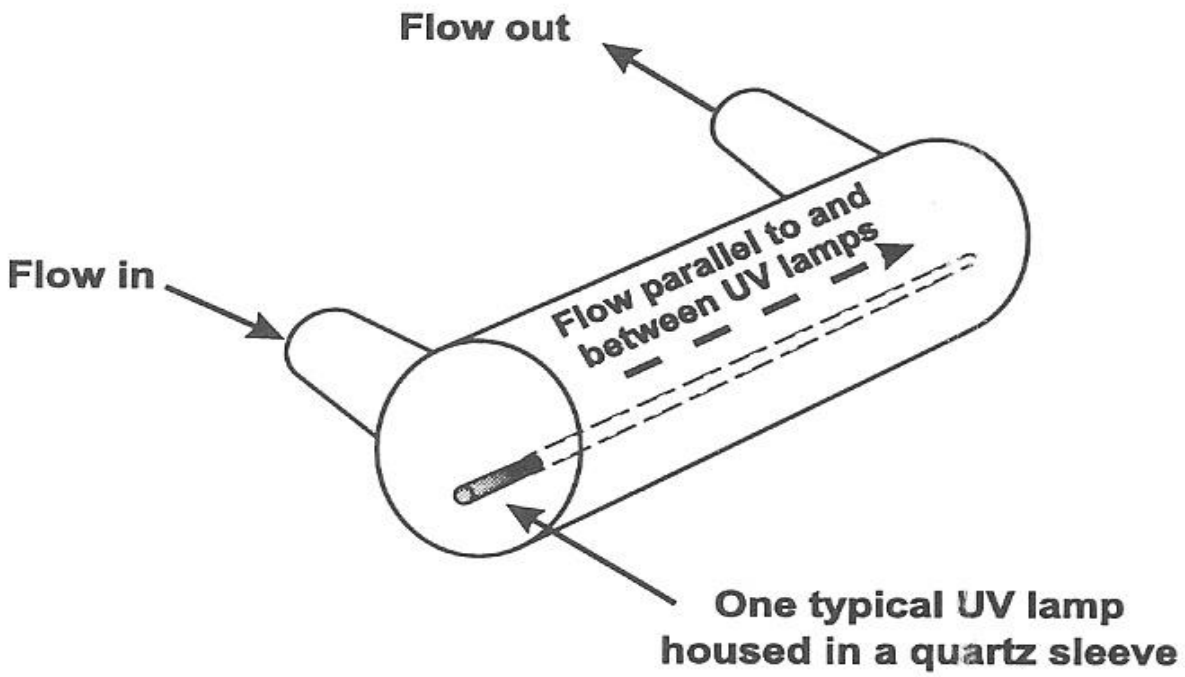
UV light radiation

- Damage the genetic structure of bacteria, viruses and other pathogens.
- Wavelength-254nm
- Advantages: no chemicals are used
- water taste more natural
- Disadvantages: high maintenance of the UV-lamp



PROCESS

Figure 3. Wastewater flow in a quartz UV unit



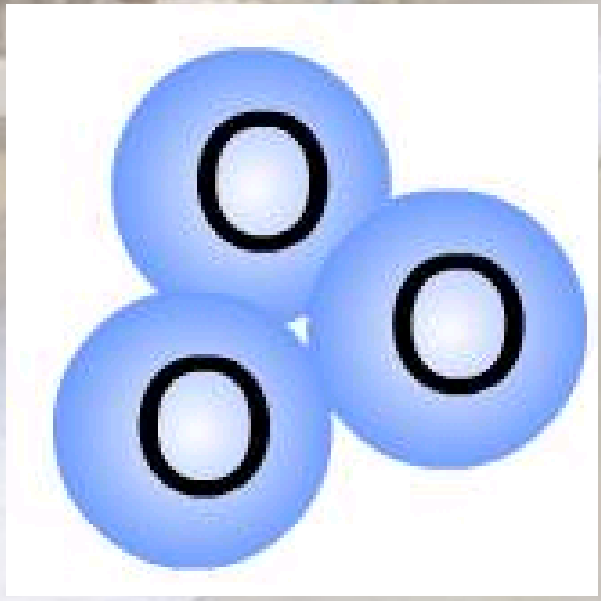
Ozonation

- Oxidized most pathogenic microorganisms
- Advantages: safer than chlorination

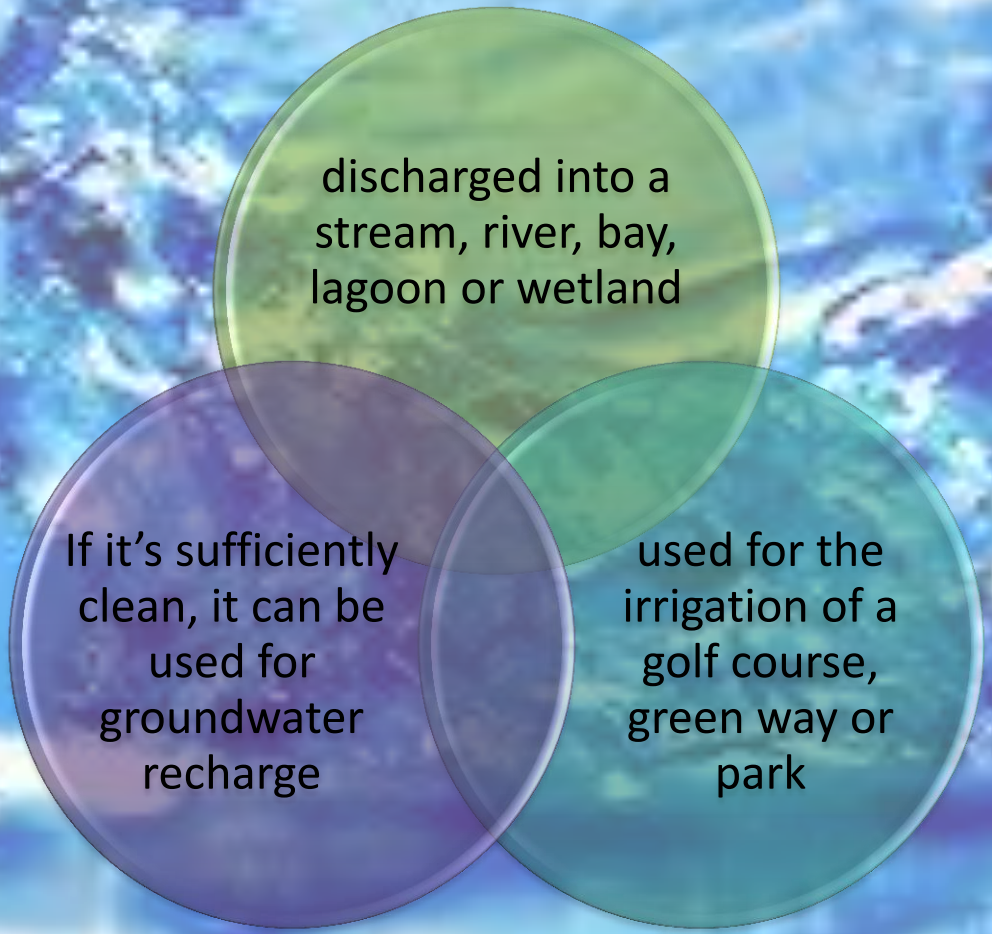
  fewer disinfection by-product

  No residual…ozone degrades to oxygen, O_2
- Disadvantage: high cost, need

Equipments and electricity



What can be effluent used for?



Thank You!