Waste Water Treatment

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Introduction

What is wastewater treatment?

- Process of removing contaminants from wastewater (from both runoff and domestic).

Introduction

Where does wastewater come from? (Source)

Two types of waste water

- Domestic Sewage
- Industrial Sewage

Introduction

Where does wastewater come from? (Source)

COMPOSITION OF WASTEWATER

- The composition of wastewater varies widely. This is a partial list of what it may contain.
- **Water (more than 95 percent), which is often added during flushing to carry waste down a drain;**
- Pathogens such as **bacteria, viruses, prions and parasitic worms**;
- **Non-pathogenic bacteria**;
- **Organic particles such as feces, hairs, food, vomit, paper fibers, plant material, humus, etc.**;
- **Soluble organic material such as urea, fruit sugars, soluble proteins, drugs, pharmaceuticals,** etc.;
- **Inorganic particles such as sand, grit, metal** particles, ceramics, etc.;

Introduction

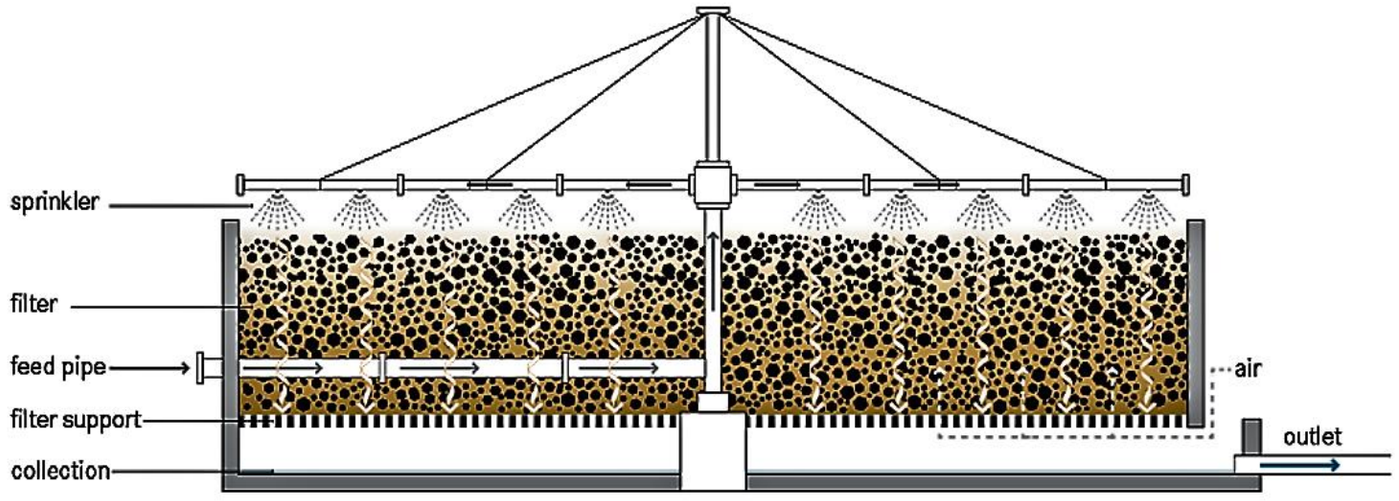
Objectives

- To eliminate hardness of water.
- To eliminate the bad smell.
- To remove the solid wastes in the sewages.
- To kill and remove the disease producing micro organisms.

Introduction

Types of treatment

- **Mechanical treatment**
  - Removal of large objects
  - Removal of sand and grit
  - Primary Sedimentation
- **Biological treatment**
  - Trickling bed filter
  - Activated sludge
- **Chemical treatment**
  - Disinfection



Steps involved in waste water treatment

- Preliminary treatment
- Primary treatment
- Secondary treatment
- Tertiary treatment

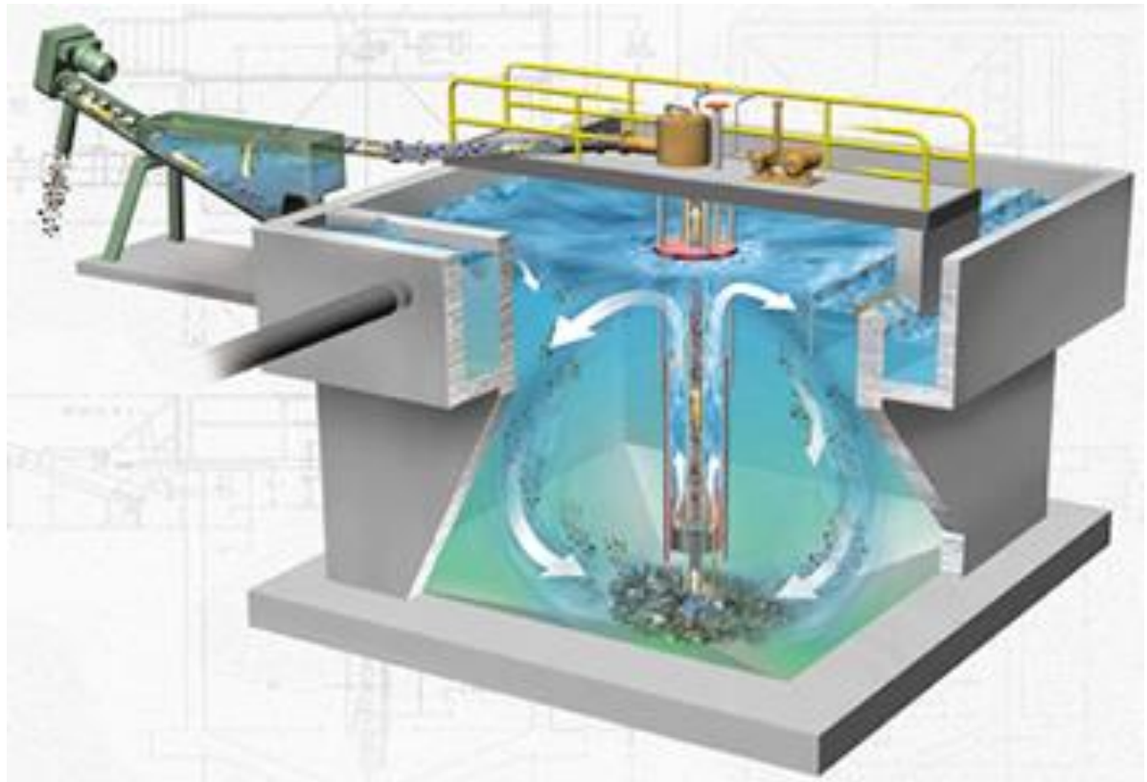
Preliminary treatment

- Solids and suspended big objects (impurities) are removed by passing the waste water through bar and mesh screens (filter).

- Screening: Bar or mesh screens hold floating debris, bulky objects, etc. that could block pipes or damage mechanical equipment in the rest of the water treatment plant.

Primary treatment

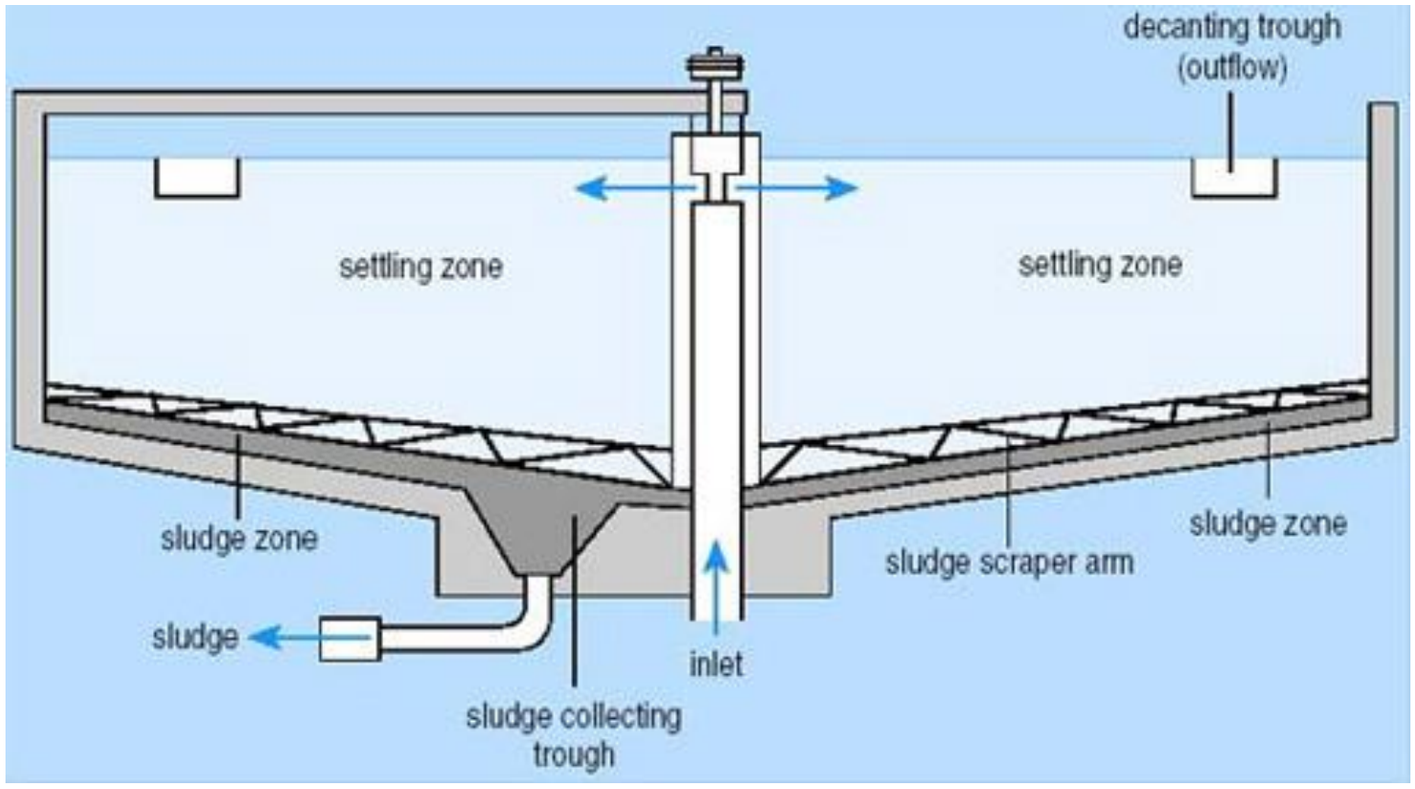
Sand and Grit Removal: A grit chamber where small particles like sand, stones etc. are allowed to settle.



Primary treatment

Sedimentation Tank

It allows suspended particles to settle out of water or wastewater as it flows slowly through the tank.

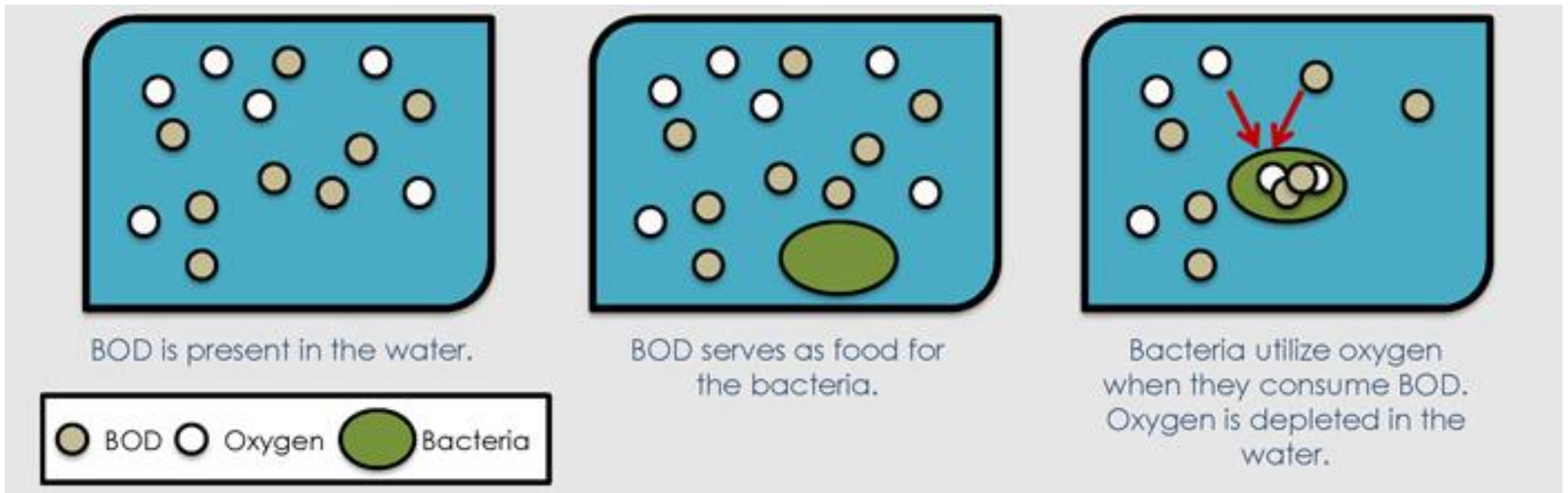


Secondary Treatment

Aim

- Secondary treatment is the removal of <u>biodegradable organic matter (in solution or suspension</u>) from sewage or wastewater. The aim is to improve the quality of effluent quality in a sewage treatment plant suitable for the intended disposal or reuse option.

$$\text{Organic material (C, O, H, N)} \xrightarrow[\text{Micro Organism}]{O_2} NH_3 + CO_2 + \text{new microorganism}$$



Secondary Treatment

- In secondary treatment, biological processes are used to remove dissolved and suspended organic material.

- These processes are performed by microorganisms (aerobic or anaerobic process).

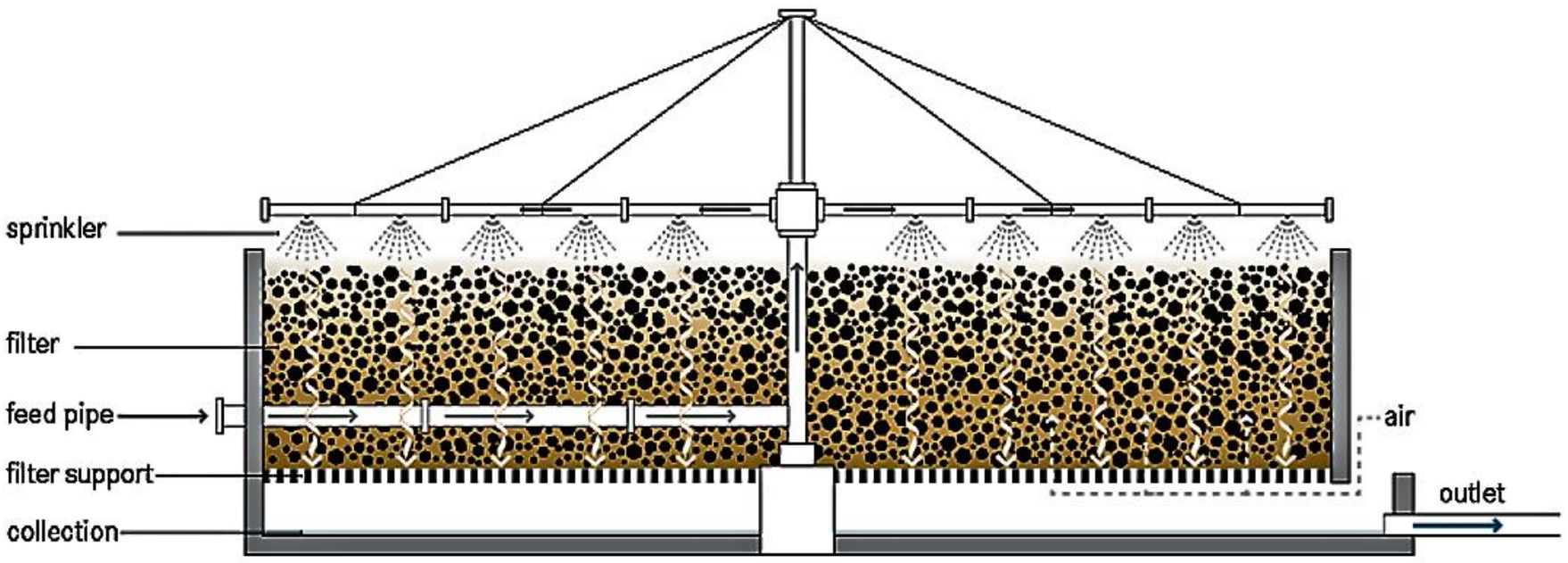
- Bacteria and protozoa consume biodegradable soluble organic contaminants (e.g. sugars, fats, and organic short-chain carbon molecules from human waste, food waste, soaps and detergent) while reproducing to form cells of biological solids.

Secondary Treatment

Treatment Types

1. Fixed film system

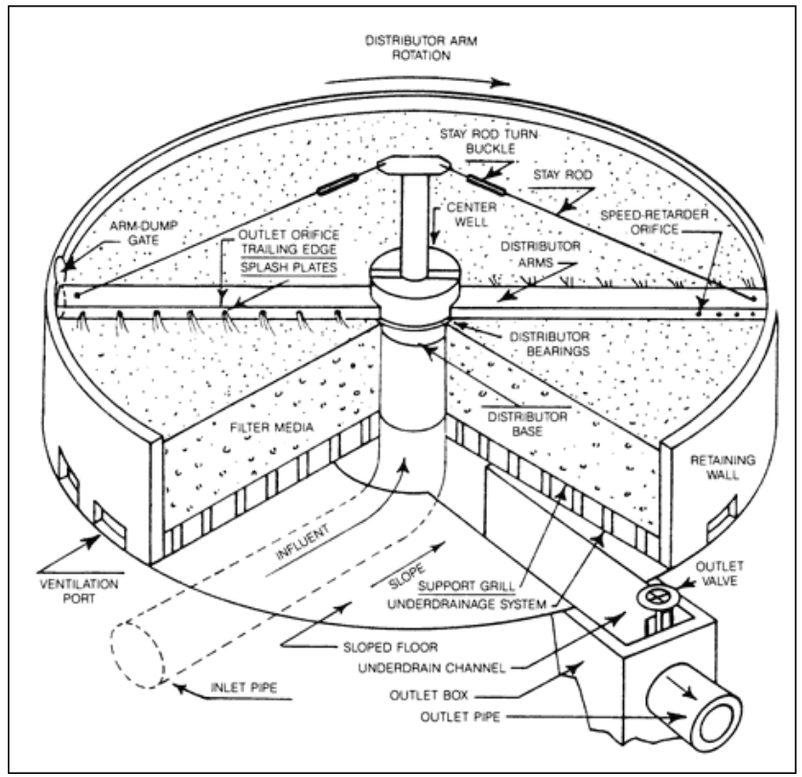
– grow microorganisms on substrates such as rocks, plastic
– wastewater is spread over the substrate
– Ex: Trickling filters, rotating biological contactors



Secondary Treatment

Steps in Trickling Filter Process

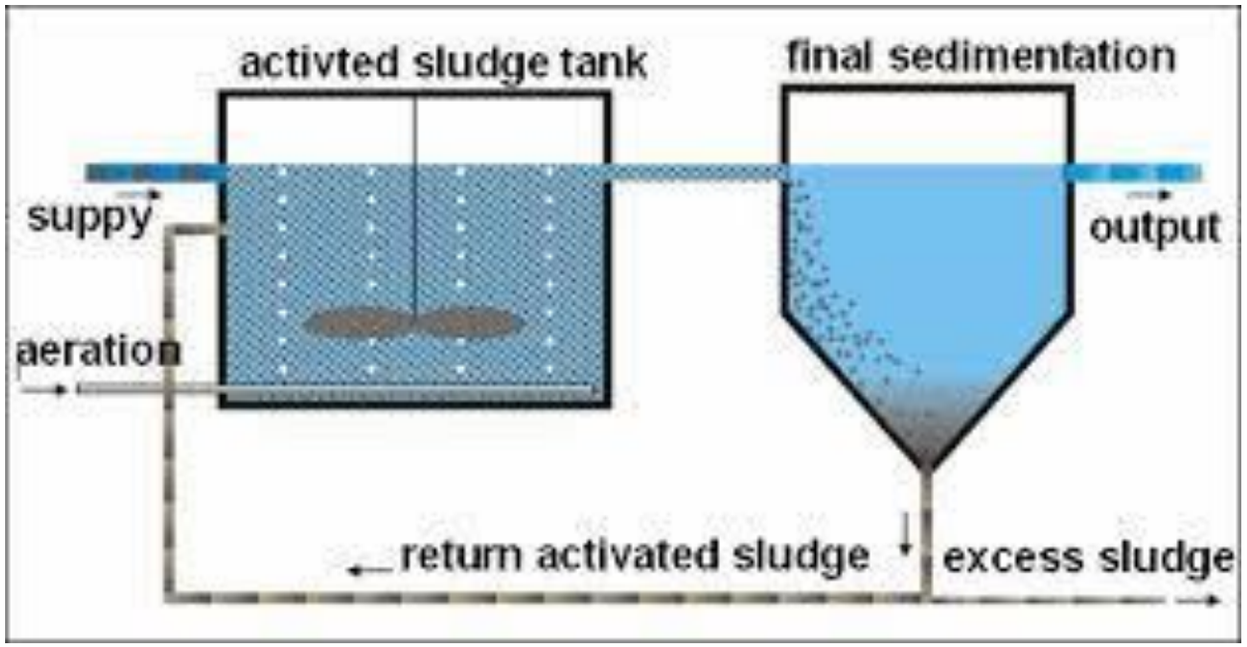
1. It is a circular tank.
2. Sewage is sprayed over crushed rocks
3. Slow rotating arm sprayer is used.
4. When sewage moves downwards microorganisms grow on rocks surface.
5. Food for the microorganisms is organic matters in sewage.
6. After aerobic oxidation sewage goes to settling tank.
7. In settling tank sludge are removed.
8. By this process 85% of BOD produced materials are removed.



Secondary Treatment

2. Suspended Film Systems

- ❖ stir and suspend microorganisms in wastewater settled out as a sludge
- ❖ pumped back into the incoming wastewater
- ❖ Ex: Activated sludge, extended aeration



Tertiary Treatment

- The purpose of tertiary treatment (advanced treatment) is final stage to further improve the effluent quality before it is discharged to the receiving water body or reused.

- Tertiary treatment refers to an additional stage of treatment of a biologically treated effluent, depending on the intended uses.

- This step can be designed to remove nutrients (if not removed in the secondary treatment step), pathogenic organisms, non-biodegradable compounds, heavy metals, remaining inorganic dissolved solids and suspended solids, or even micropollutants).

- In this way, the final effluent meets a stricter standard than that achieved only with secondary treatment, which may allow the reuse of the effluent in certain situations.

- Several tertiary treatment processes can be employed depending on the purpose, with some of the most used being the following: membrane separation processes (microfiltration, ultrafiltration, and reverse osmosis), adsorption (activated carbon), ion exchange, disinfection (chlorination; ozone gas, UV light) etc.

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Schematic of Wastewater treatment methods