

Types of Water Treatment in industry

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1. Introduction

- 'Source of water' refers to the origin or location from which water is obtained.
- It can be various natural or artificial sources where water is found and extracted for human use, consumption, or industrial processes.
- The choice of water source depends on factors such as availability, quality, accessibility, cost and environmental sustainability.
- It is essential to manage and protect water sources to ensure adequate supplies for current and future generations while minimizing adverse environmental impacts.

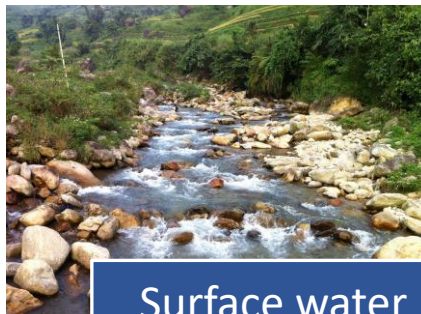
1.1 Source of water

1. Surface Water:

- Water found in the natural water bodies such as rivers, lakes, streams, and reservoirs.
- Often used as a source of drinking water, irrigation, recreation, and industrial purposes.

2. Groundwater:

- Water found beneath the Earth's surface in underground aquifers, rock formations, and soil layers.
- It is accessed through wells and boreholes and is used for drinking water supplies, agriculture, industrial processes, and groundwater recharge



Surface water



Ground water

1.1 Source of water

3. Rainwater:

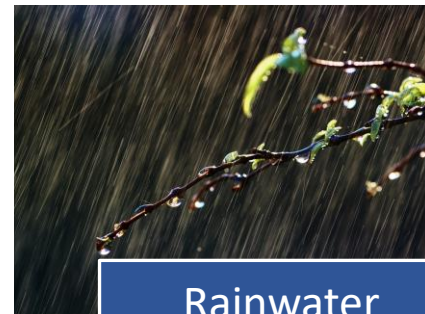
- Precipitation that falls from the atmosphere in the form of rain.
- It can be collected and stored for various purposes such as irrigation, landscaping, non-potable uses, and groundwater recharge.

4. Spring Water:

- Groundwater naturally emerges from the Earth's surface in the form of springs.
- often considered clean and mineral-rich and is bottled for drinking purposes.



Spring water



Rainwater

1.1 Source of water

5. Desalinated Water:

- By removing salt and other impurities from seawater or brackish water through desalination processes such as reverse osmosis or distillation.
- Used to supplement freshwater supplies in regions facing water scarcity or for industrial purposes.

6. Recycled Water:

- Also known as reclaimed water or wastewater, is treated sewage or wastewater.
- Undergone purification processes to remove contaminants and pathogens.
- Used for irrigation, landscape irrigation, industrial processes, and groundwater recharge with certain groundwater legal approvals.



Desalinated water



Recycled water

1. Source of water

7. Glacial Water: Glacial water is water sourced from glaciers and ice caps in polar regions and mountainous areas. Glacial water is often considered to be pure and mineral-rich and is used for drinking purposes and bottling.

8. Melted water: Meltwater is water derived from snow and ice melting. Meltwater is an important source of freshwater for rivers, lakes, and groundwater recharge, especially in regions with seasonal snow and ice cover.



Glacier water



Melted water

2. Analysis of water

#	Description
1	Physical Characteristics
2	Chemical Parameters
3	Microbiological Parameters
4	Sediment Analysis
5	Toxicity Testing

2.1 Physical Characteristics

#	<u>Characteristics</u>	Description
1	Temperature	Provides insights into seasonal variations, thermal pollution, and habitat suitability for aquatic organisms
2	Turbidity	1. Measures the clarity of water 2. indicates the presence of suspended particles 3. High turbidity levels can impair aquatic ecosystems and affect water treatment processes
3	Color	Helps identify natural and anthropogenic sources of contamination in surface water

2.2 Chemical Parameters

#	Parameters	Description
1	pH	Assess the acidity or alkalinity of water, which impacts aquatic life, chemical reactions, and corrosion potentialhabitat suitability for aquatic organisms
2	Dissolved Oxygen (DO)	Analysing nutrients like nitrogen and phosphorus helps assess eutrophication potential and identify sources of nutrient pollution.
3	Nutrients	Helps identify natural and anthropogenic sources of contamination in surface water
4.	Heavy Metals	Monitoring heavy metals such as lead, mercury, arsenic, and cadmium helps detect pollution from industrial discharges, mining activities, and urban runoff
5.	Pesticides and Herbicides	Helps in assessment of contamination from agricultural runoff and pesticide applications.

2.2 Chemical Parameters (Cont.)

#	Parameters	Description
6	Organic Compounds	1. Including volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs), 2. Helps in identifying pollution from industrial discharges, urban runoff, and wastewater treatment plants.
7	Chlorine Residual	Chlorine residual analysis assesses disinfection levels in surface water treated for drinking purposes
8	Oil and Grease	Testing for oil and grease contamination helps identify pollution from oil spills, industrial discharges, and urban runoff.

2.3 Microbiological Parameters

#	Parameters	Description
1	Total Coliforms and Escherichia coli (E. coli)	Microbiological analysis assesses faecal contamination and the risk of waterborne diseases
2	Faecal Streptococci	•Monitoring faecal streptococci levels helps assess water quality and faecal contamination

2.4 Sediment Analysis

- **Sediment Composition:** Analysing sediment composition provides insights into sedimentation rates, erosion processes, and potential pollutant transport.
- **Particle Size Distribution:** Particle size analysis helps assess sediment characteristics and transport dynamics in surface water bodies.

2.4 Toxicity Testing

- **Bioassays:** Toxicity testing using bioassays helps evaluate the impact of pollutants on aquatic organisms and assess overall water quality.
- Regular monitoring and analysis of water parameters are essential for managing water resources, protecting ecosystems, and safeguarding human health. The selection of analysis parameters depends on factors such as regulatory requirements, environmental concerns, land use activities, and water management objectives.

3. Water treatment method

Water treatment methods are used to improve the quality of water for various purposes, including drinking, industrial processes, irrigation, and environmental protection.

Different treatment methods are applied based on the source water quality, intended use, regulatory requirements, and specific contaminants present. Here are some common water treatment methods:

1. Filtration:

- a. **Sand Filtration:** Sand filters are used to remove suspended solids, sediment, and larger particles from water by passing it through layers of sand or other media.
- b. **Activated Carbon Filtration:** Activated carbon filters adsorb organic compounds, chlorine, taste, and odor compounds from water, improving its taste and odor.

3. Water treatment method (Cont.)

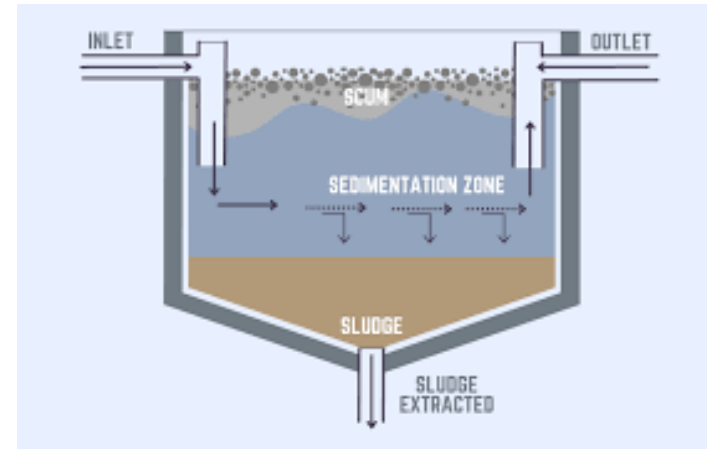
2. Coagulation and Flocculation:

- a. **Chemical Coagulation:** Chemical coagulants such as aluminum sulfate (alum) and ferric chloride are added to water to destabilize suspended particles, facilitating their removal by settling or filtration.
- b. **Flocculation:** Flocculation involves gentle mixing to promote the aggregation of destabilized particles into larger flocs, which can be more easily removed through sedimentation or filtration

3. Water treatment method (Cont.)

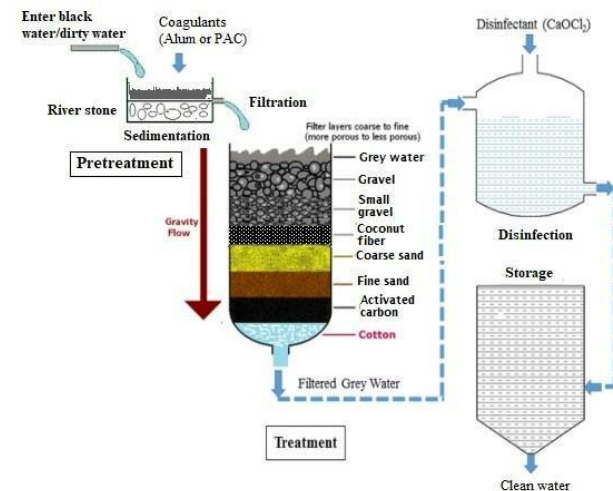
1. Sedimentation:

- a. **Clarification:** Clarification tanks allow suspended particles and flocs to settle under gravity, resulting in clearer water that can be separated from the settled solids.

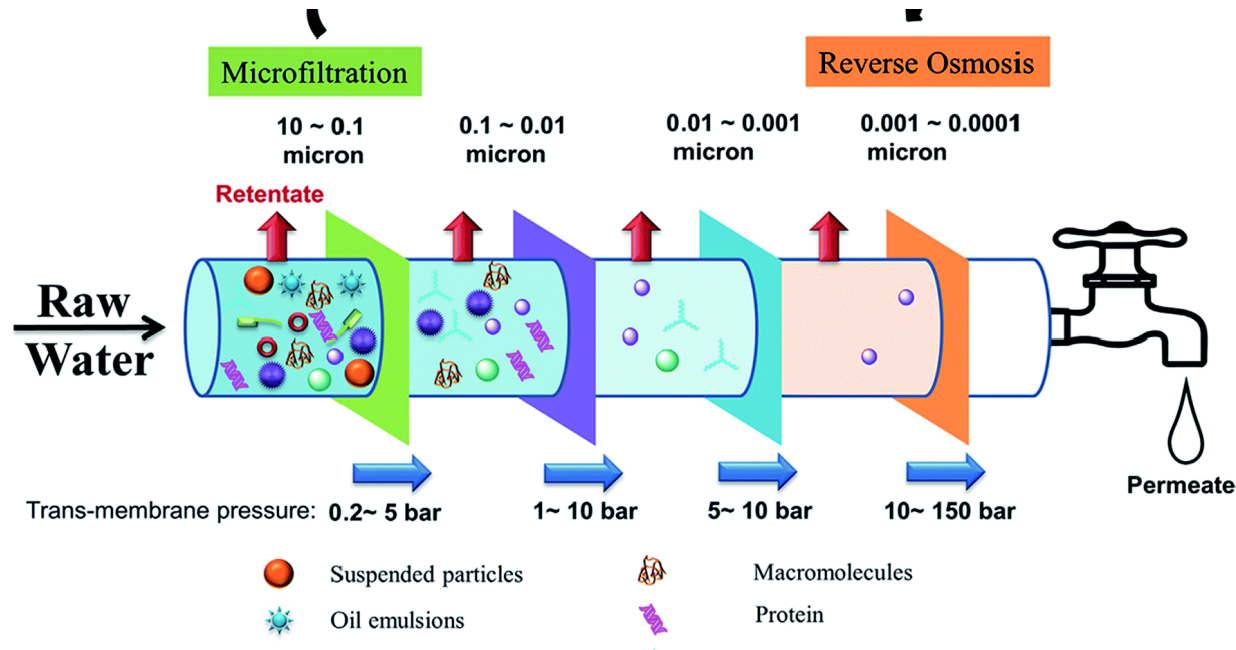


2. Disinfection:

- a. **Chlorination:** Chlorine is commonly used for disinfection to kill bacteria, viruses, and other pathogens in water. It is added as chlorine gas, sodium hypochlorite, or calcium hypochlorite.
- b. **UV Disinfection:** Ultraviolet (UV) light is used to disinfect water by damaging the DNA of microorganisms, rendering them unable to reproduce.



3. Water treatment method (Cont.)



3. Membrane Processes:

- Reverse Osmosis (RO):** RO systems use semi-permeable membranes to remove dissolved solids, salts, and contaminants from water, producing high-quality treated water.
- Ultrafiltration (UF):** UF membranes remove suspended solids, bacteria, and some viruses from water by size exclusion.

3. Water treatment method (Cont.)

4. Ion Exchange:

- a. **Water Softening:** Ion exchange resins are used to remove calcium and magnesium ions from water, reducing hardness and preventing scale buildup in plumbing and appliances.

5. Adsorption:

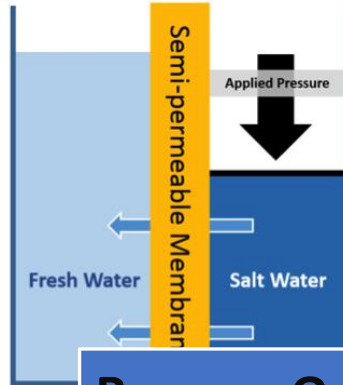
- a. **Ion Exchange:** Ion exchange resins can also be used to remove specific ions such as nitrates, arsenic, and heavy metals from water.
- b. **Activated Carbon:** Activated carbon adsorbs organic compounds, VOCs, and certain chemicals from water, improving its quality and taste.

6. Desalination:

- a. **Reverse Osmosis:** RO is commonly used for desalination to remove salts and minerals from seawater or brackish water, producing freshwater suitable for drinking and irrigation.

3. Water treatment method (Cont.)

Reverse Osmosis



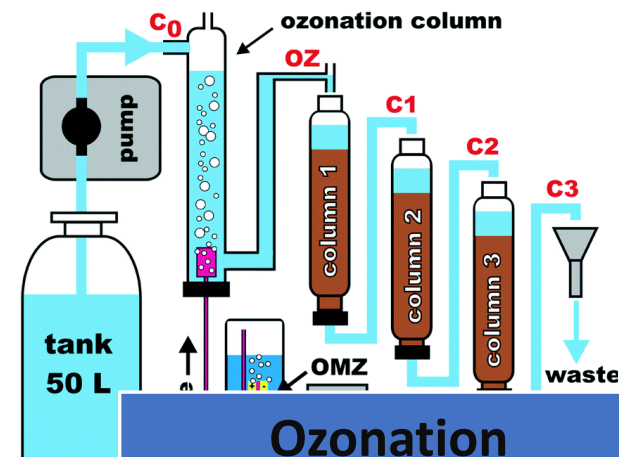
Reverse Osmosis (RO)



Ultrafiltration (UF)



Ion Exchange



Ozonation

3. Water treatment method (Cont.)

7. Oxidation:

- a. **Ozonation:** Ozone is a powerful oxidizing agent used to oxidize and destroy organic compounds, microorganisms, and contaminants in water, improving its quality and safety.

8. Advanced Oxidation Processes (AOPs):

- AOPs such as ozone/hydrogen peroxide, UV/hydrogen peroxide, and ozone/UV processes are used to remove persistent organic pollutants and emerging contaminants from water through oxidative reactions.

These are just some of many water treatment method available. The selection and combination of treatment method depends on specific water quality issues, treatment goals, cost consideration and regulatory requirement for each application. Proper treatment and water management resources are essential for ensuring public health, environmental protection and sustainable development.

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