Presentation

On

RO – 05 – Fouling Pretreatment Solution

Prepared By

Md. Shafikul Islam

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RO – 05 – Fouling Pretreatment Solution

Water Impurities

Water has some Impurities on to it

- Ionic Type Impurity
- Non-Ionic Type Impurity
- Gas Type Impurity
- Particulate Type Impurity

RO

Water Impurity – Ionic Type

Water Impurity – Ionic Type

Cations Type	Anions Type
Ca ion	Cl ion
Mg ion	NO3 ion
Na ion	SO4 ion
K ion	HCO3 ion
Fe ion	CO3 ion
Mn ion	SiO3 ion
Al ion	PO4 ion
NH4 ion	

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Water Impurity – Non-Ionic Type

Water Impurity – Non-Ionic Type

- Colloid Type Material
- Suspended Solids
- Microbiological Type
  - Bacterial Type
  - Viral Type
  - Algal Type
  - Pyrogenic Type

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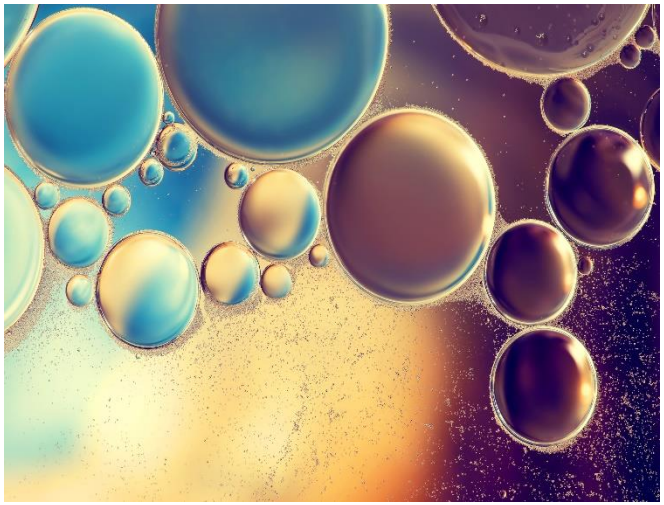
Water Impurity – Gas Type

Water Impurity – Gas Type

- Carbon Di-Oxide [CO2]
- Oxygen[O2]
- Chlorine [Cl]
- Nitrogen [N2]
- Hydrogen Sulfide [H2S]



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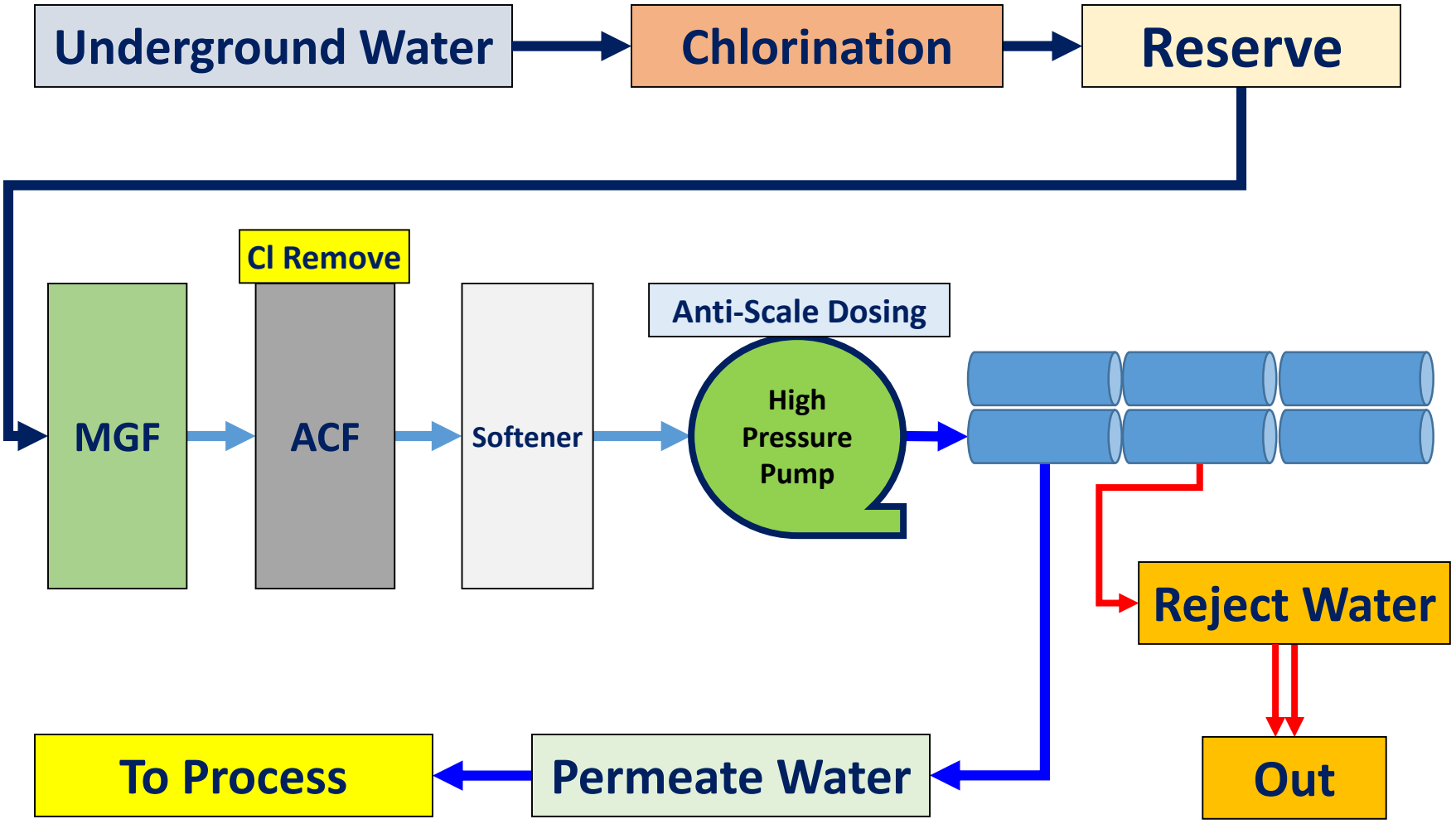
Water Impurities & Removal System

Water Impurities & Removal System	
Ionic Impurity	RO, Nano Filtration
Non-Ionic Impurity	RO, Nano Filtration
Particulate Impurity	RO, Nano Filtration
Gas Type Impurity	De-Gasifier

RO

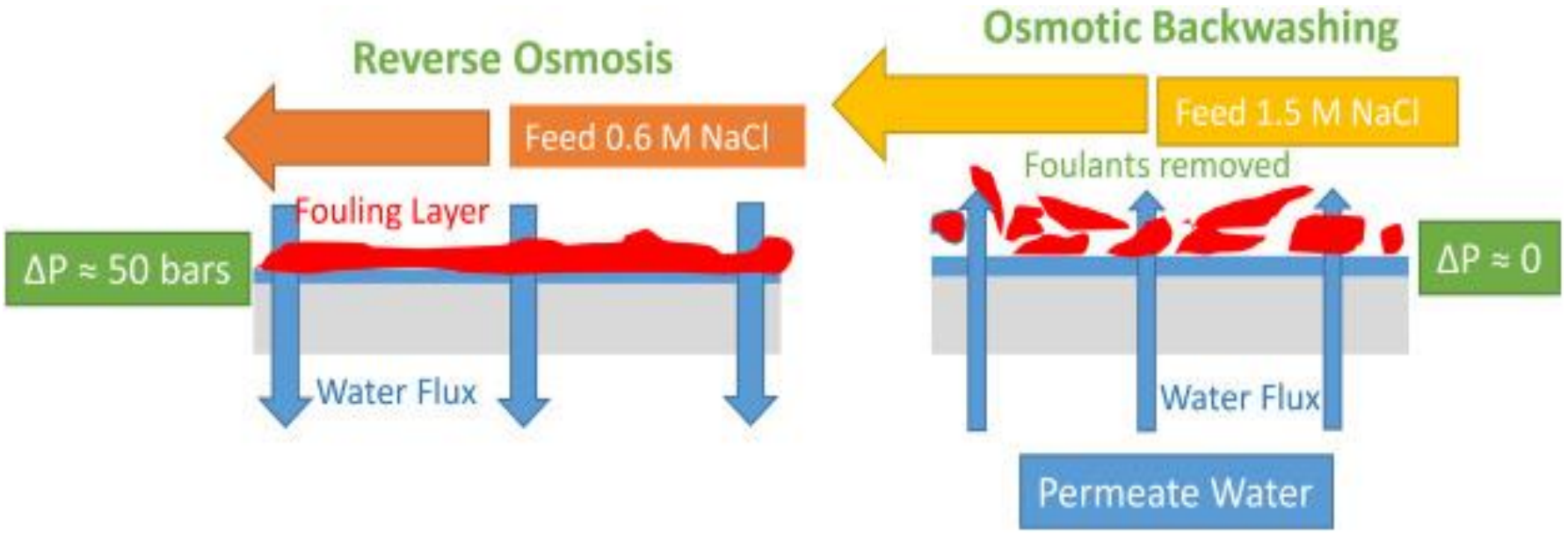
Basic Components of RO Plant



RO Fouling

Contaminants get accumulated on **Membrane Surface**

Contaminants **Pose the Ability to Perform Quick Plugging**



Fouling starts in the **Front End &** Results **High Pressure Drop**

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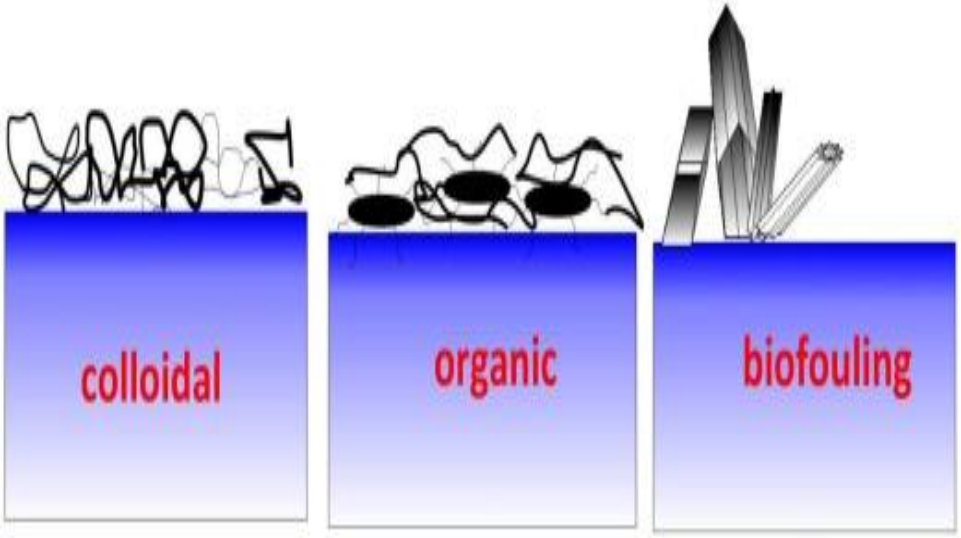
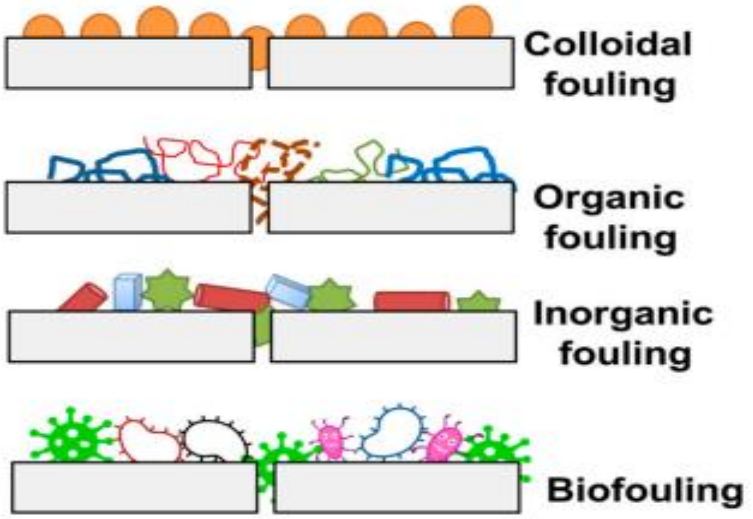
RO Fouling

During Fouling, the Permeate Flow Gets Down

Fouling Incurs the **Higher Operating Cost** & **Membrane Change**





Proper Pretreatment = Minimal Chance of RO Fouling

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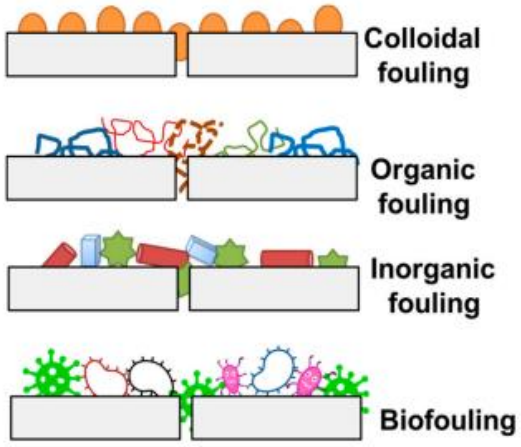
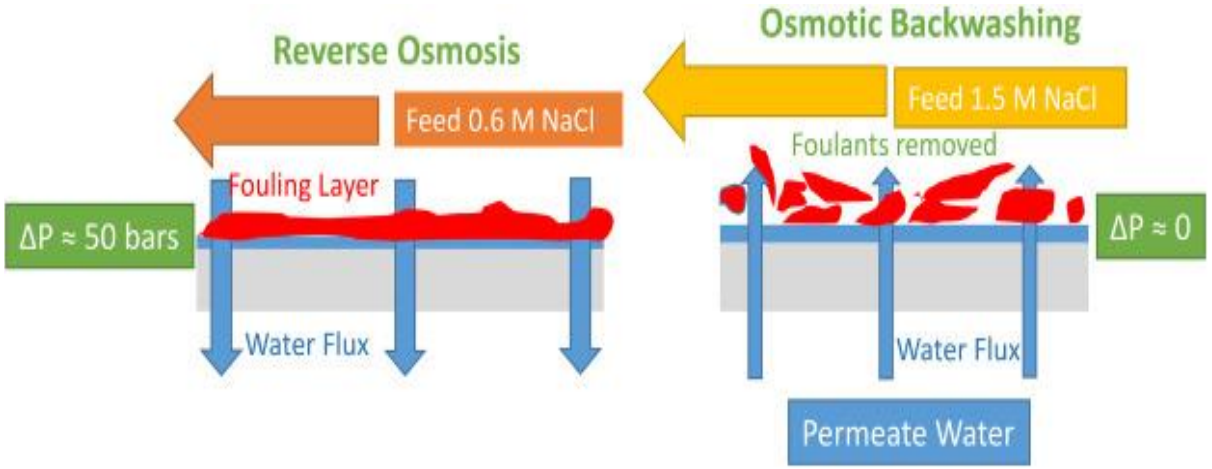
RO Fouling - Cause

RO Fouling Can be Caused By

- **Colloidal or Particulate Matter** [with Dirt, Silt, clay etc.]
- **Organic Matter**
- **Biofilms/Micro-organisms** [Bacteria with biofilms]
- Breakthrough **of Filter Media Upstream** [**Softener Leaking**]

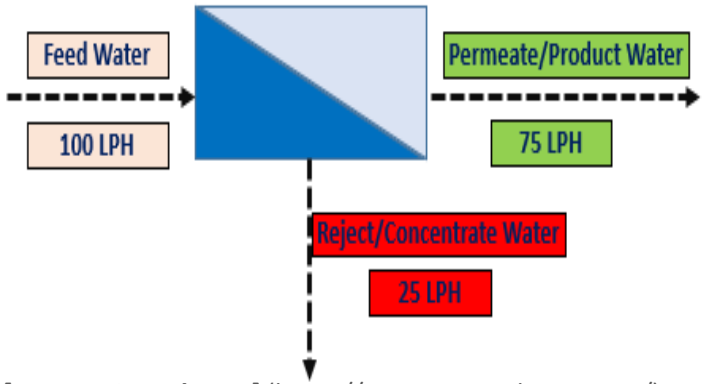




Fouling starts in the **Front End** & Results **High Pressure Drop**

RO – Membrane Problem Result

RO – Membrane Problem Result
Water Quality will be Very Poor
Water Production will be Very Low
Tends to perform Frequent Cleaning
Tends to perform Membrane Replacement
Operating Cost will be hampered & will be High



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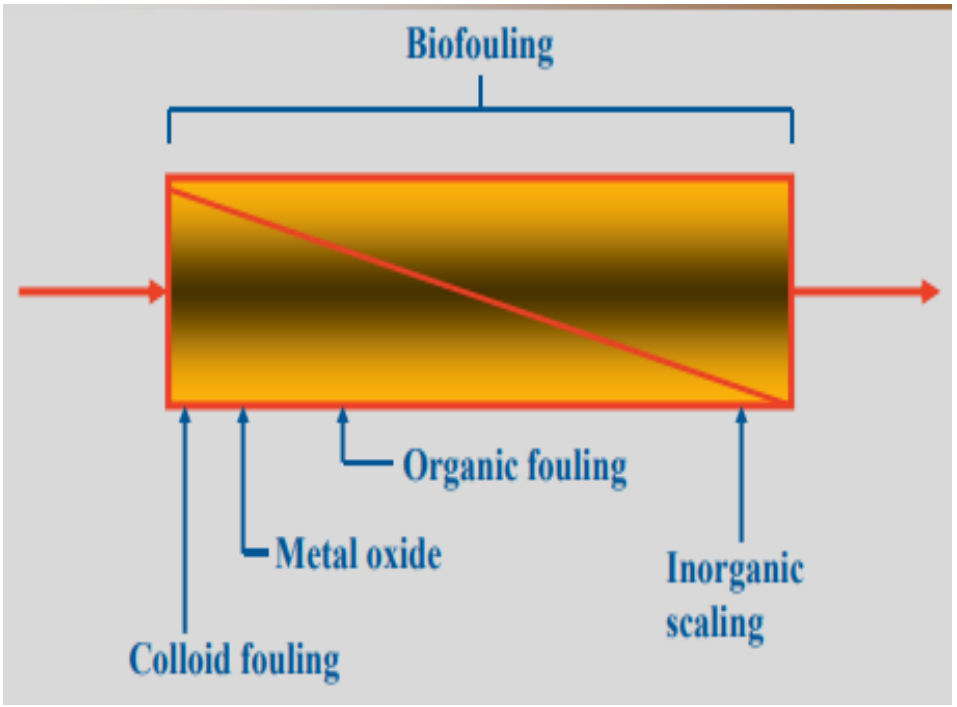
RO – Common Problem

RO – Common Problem found in System

Different Fouling	Scale Forming	Mechanical
Colloidal Fouling		
Organic Fouling		
Microbial Fouling		



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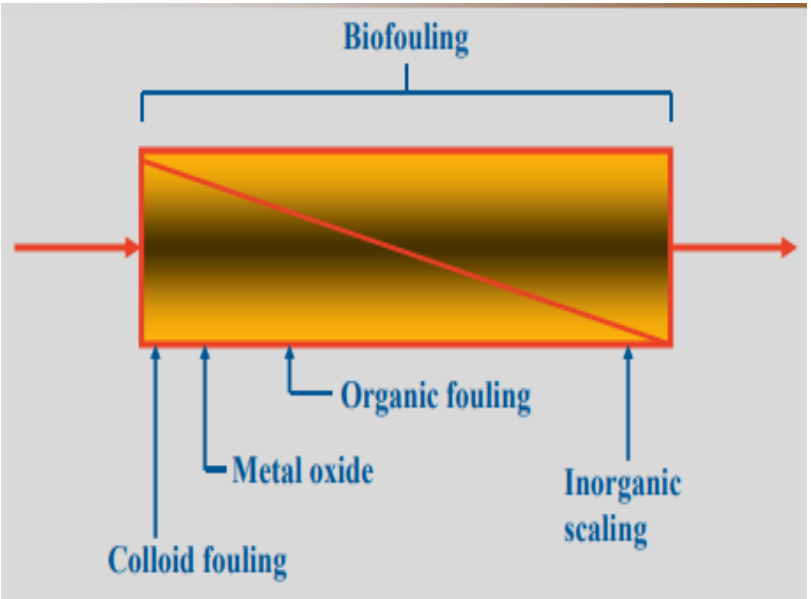
RO Pretreatment

To Prevent RO Failure & RO Frequent Cleaning

RO Pretreatment

Mechanical Pretreatment

Chemical Pretreatment



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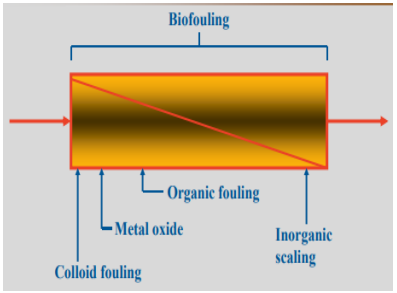
RO Pretreatment – Popular Method

RO Pretreatment – Popular Methods are…

- MFG [Multi Grade Filter] Using
- Cartridge Filter Using
- Microfiltration Unit Using
- Antiscalant and Scale Inhibitor Using
- Softener [with Ion-Exchange]
- Sodium Bi Sulfite or Sodium Meta Bi Sulfide Injection
- Granular Activated Carbon Using [GAC]



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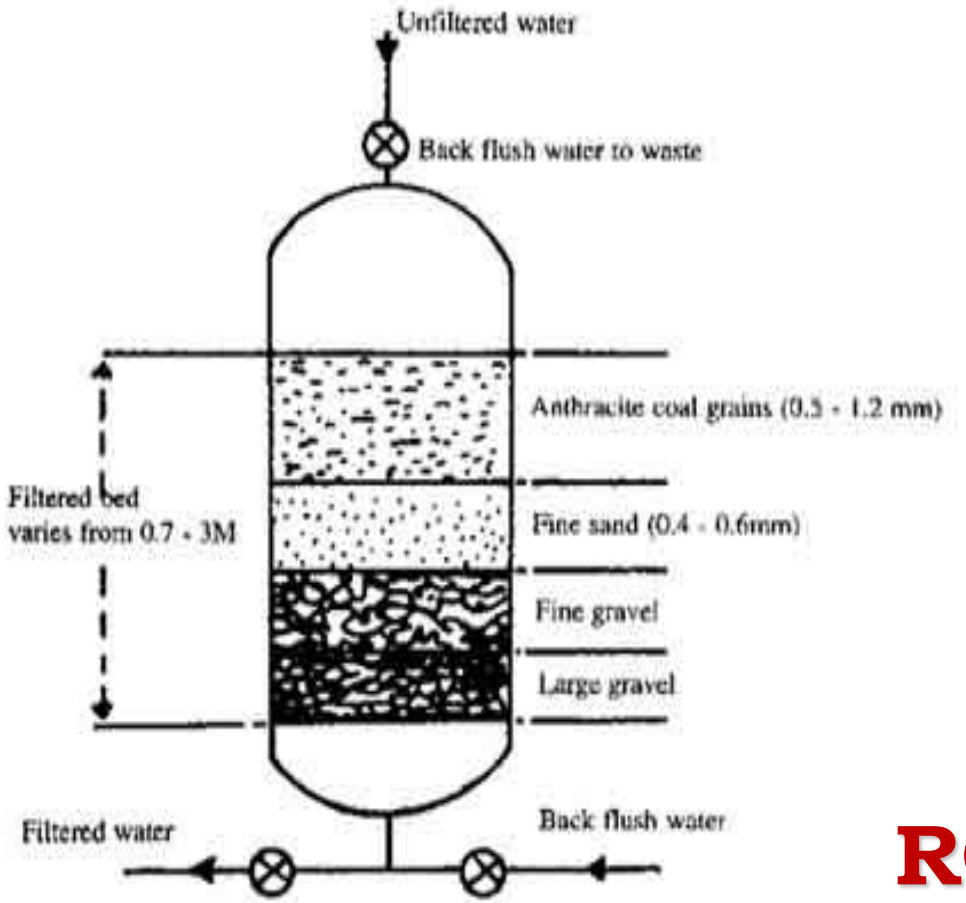
A] MGF [Multi Grade Filter] Using

MGF is a **Cost Effective System & work under High Pressure**

MGF is a **Cost Effective System & work under High Flow Rate**



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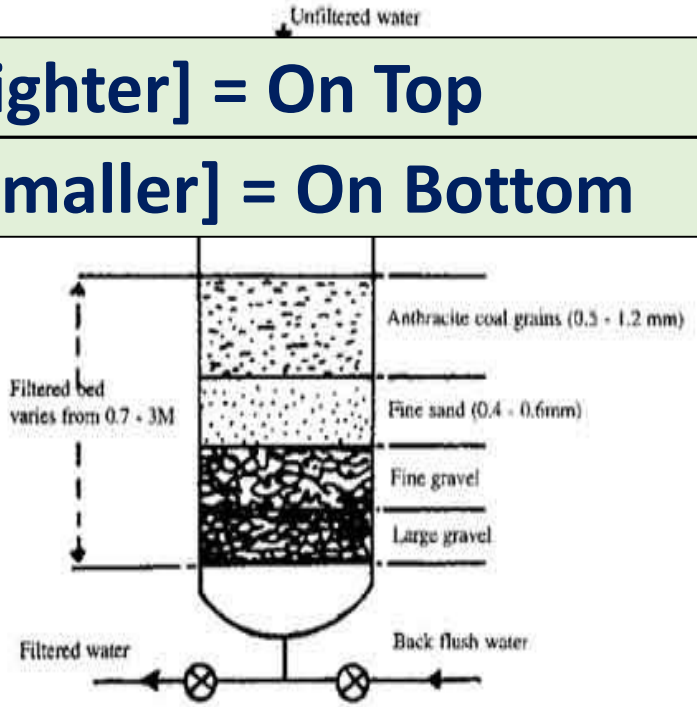
A] MGF [Multi Grade Filter] Using

To Prevent the RO Fouling

- Having **03-Layers of Anthracite Coal, Sand, Garnet**
- Having a **Gravel Layer for Supporting the System**
- **Media** is Chosen based on **Size & Density**

- **Larger Anthracite [but Lighter] = On Top**
- **Havier Anthracite [but Smaller] = On Bottom**



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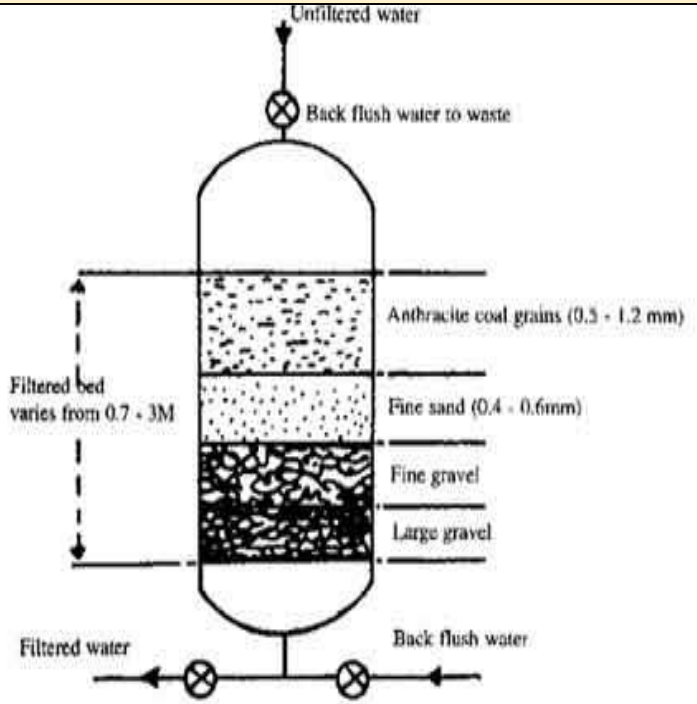
A] MGF [Multi Grade Filter] Using

Good MGF can remove Particles down to 15-20 micron

If Coagulant Use then Particle down to 05-10 micron

If, SDI > 03, then MGF is Recommended

If, Turbidity > 0.2 NTU, then MGF is Recommended



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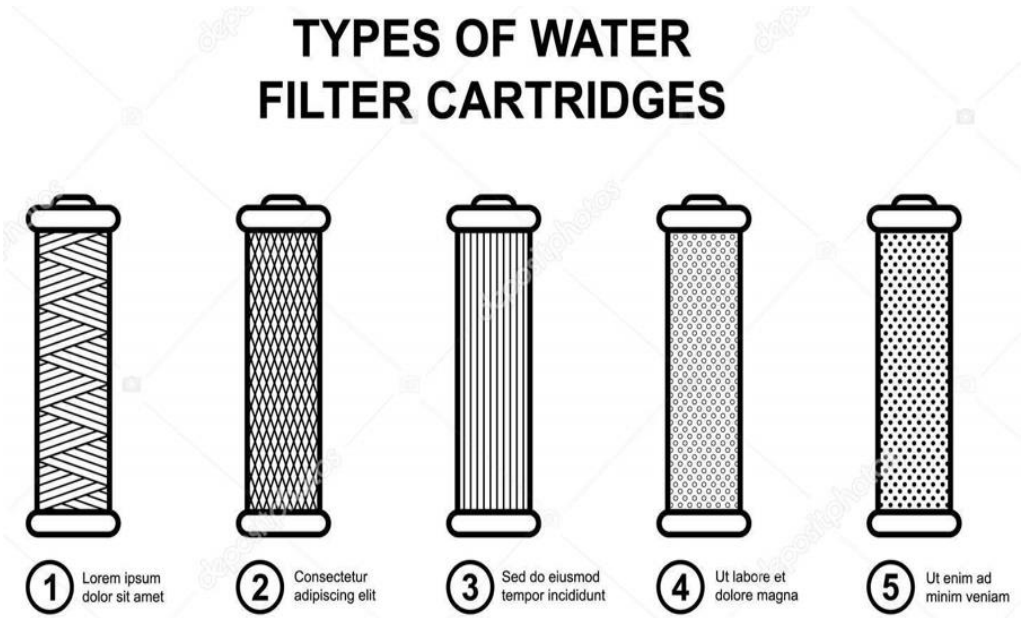
B] Cartridge Filter Using

Cartridge Filter is Very Much Useful if Placed Right after MGF

Cartridge Filter Size Should Be 05 micron



Cartridge Filter Will Ensure **RO Filter Stability**

The Output of Cartridge Filter will be **Below 05 micron**

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C] Microfiltration Unit Using

Microfiltration Has **Pore Size** Ranging From **0.1-10 micron**

Microfiltration is **Effective against Colloid & Bacteria Particle**

Hollow Fiber Type is most **Commonly Used**

The Recovery Rate >90%

RO

D] Antiscalant & Scale Inhibitors Using

Antiscalant are the **Chemical means of Support**

Antiscalant are used **in Feed Water in Steady Rate**

Purpose = **To Reduce the "Scaling Potential"**

Function = **To Increase "Solubility Limit of Organic Matter"**

RO

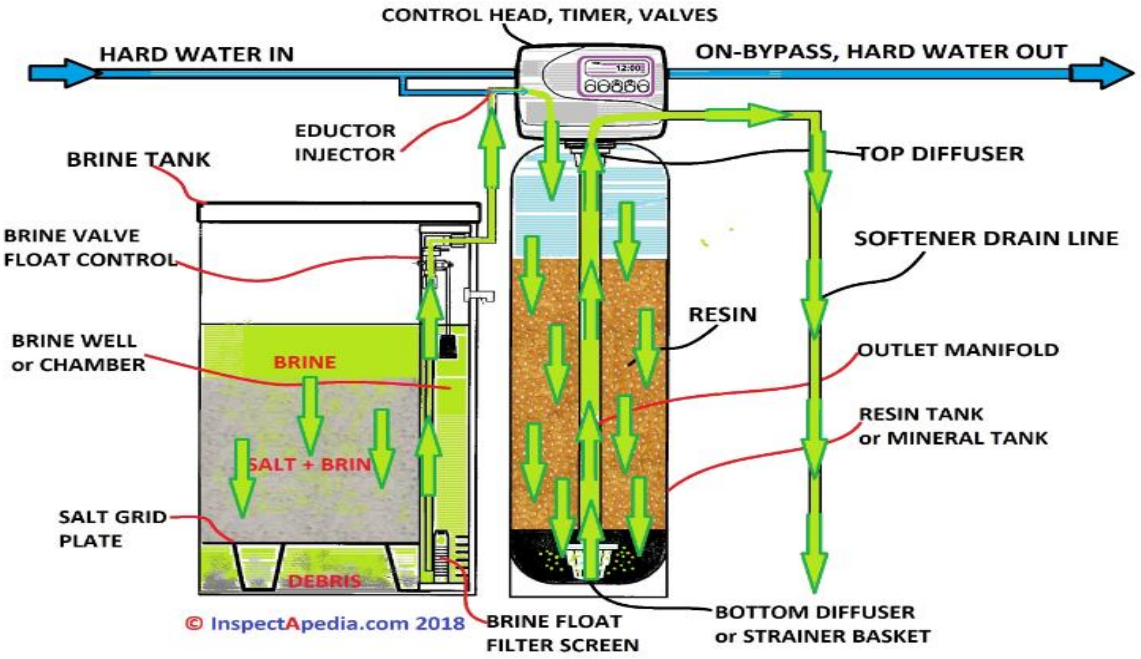
E] Softener [with Ion-Exchange]

Softener = Removes the **Hardness of Water [Ca+, Mg+…]**

Hard Water Tends to **Degrade the Water Quality**

Hard Water affects **Process, Boiler, Chiller, Cooling Tower**

Softener is an **Ion-Exchange Process**



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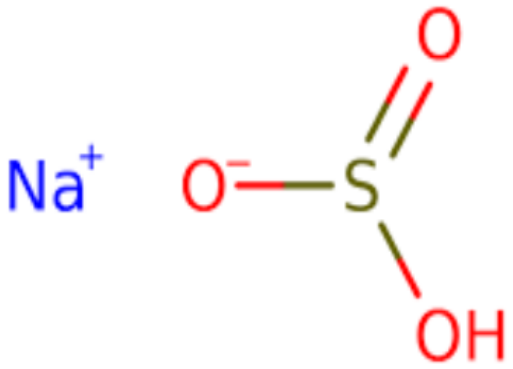
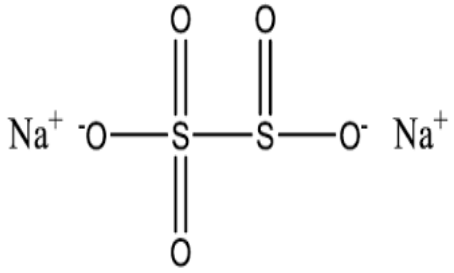
F] Sodium Bi Sulfite or Sodium Meta Bi Sulfide Using

Chlorine & Chloramine Use to Control Microbial Growth

Sodium Bi Sulfite is used to **Control Residual Chlorine**

Sodium Meta Bi Sulfite is used to **Control Residual Cl**





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G] Granular Activated Carbon Using [GAC]

Chlorine & Chloramine Use to Control Microbial Growth

Appropriate Source of GAC = Coal, Coconut Shell, Wood

Transform Chlorine → Chloride Ion [Non-Oxidizer]

Sodium Bi Sulfite is used to **Control Residual Chlorine**

RO

RO - Monitoring

RO Monitoring is very much Important Thing

Entire RO is a Costly Item

RO Fouling tends to be the Change of Membrane

Pretreatment: 90% of Operational Problems are found here

System: 90% of Operational Problems are found here

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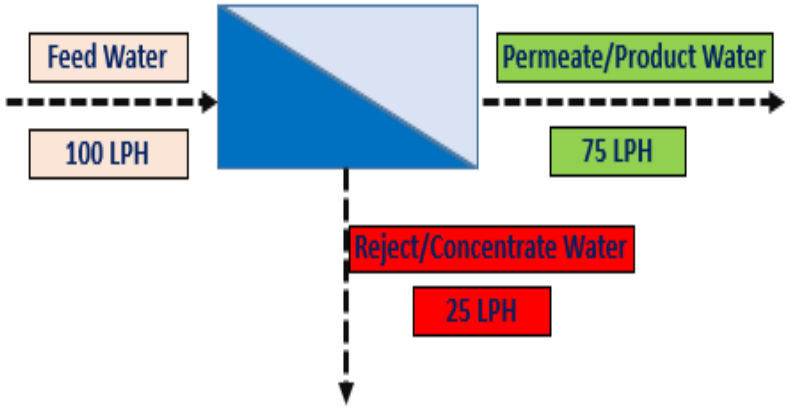
RO – Monitoring [Pretreatment]

RO Pretreatment Monitoring

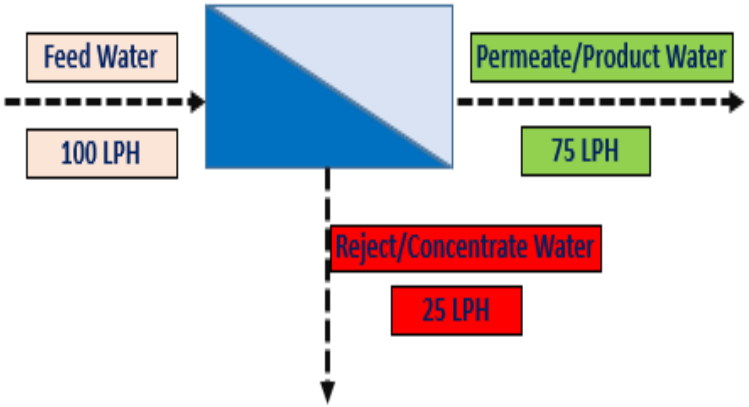
- Silt Density Index [SDI]
- pH
- Chlorination
- Turbidity
- Temperature
- Pressure
- Conductivity
- Microbiological Foulants [Bacteria, Silica, Hardness

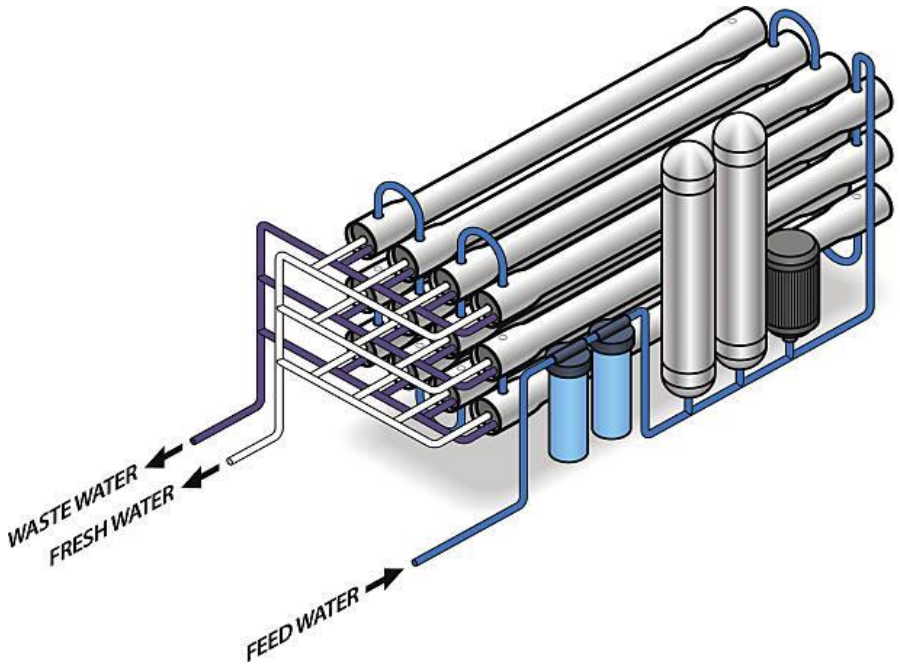


RO – Monitoring [System]

RO System Monitoring

- Present Salt Rejection
- Differential Pressure
- Percent Recovery





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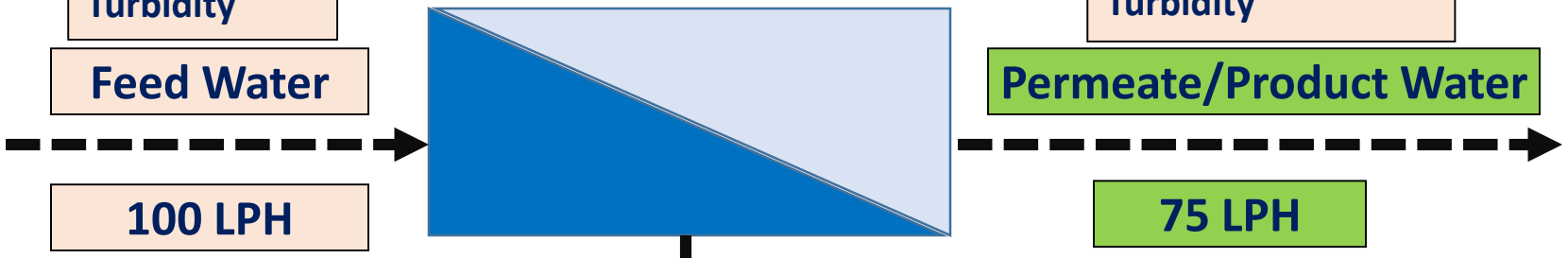
RO – Important Parameter Location

Feed Flow,
Feed Pressure
pH,
SDI
Temperature,
Conductivity,
Turbidity

Feed Water

100 LPH



Permeate Flow,
Permeate Pressure,
pH,
Temperature,
Conductivity,
Turbidity

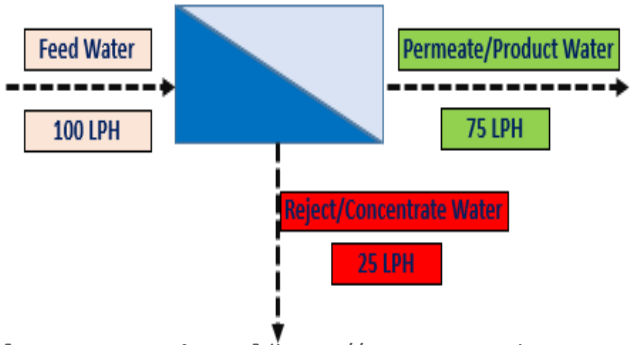
Permeate/Product Water

75 LPH

Reject/Concentrate Water

25 LPH

Reject Flow,
Reject Pressure,
Conductivity,
Turbidity



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RO – Daily Operation & Performance Data

RO – Daily Operation & Performance Data

Feed Water pH	Permeate Water pH, Temp.
Feed Water Temperature	Permeate Water Conductivity, Turbidity
Feed Water Conductivity	Permeate Water Flow, Pressure
Feed Water Turbidity	Reject Water Flow, Pressure
Feed Water SDI	Reject Water Conductivity, Turbidity
Feed Water Flow	**Percent Salt Rejection [Calculated]**
Feed Water Pressure	**Differential Pressure [Calculated]**
Daily Graphical Trend	**Percent Recovery [Calculated]**

RO

Any Question…!?

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