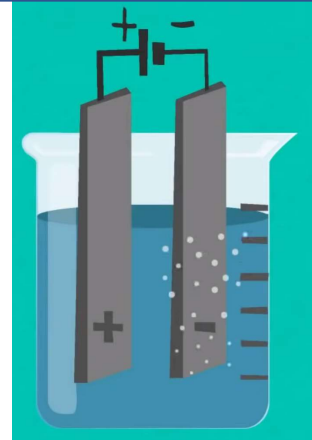
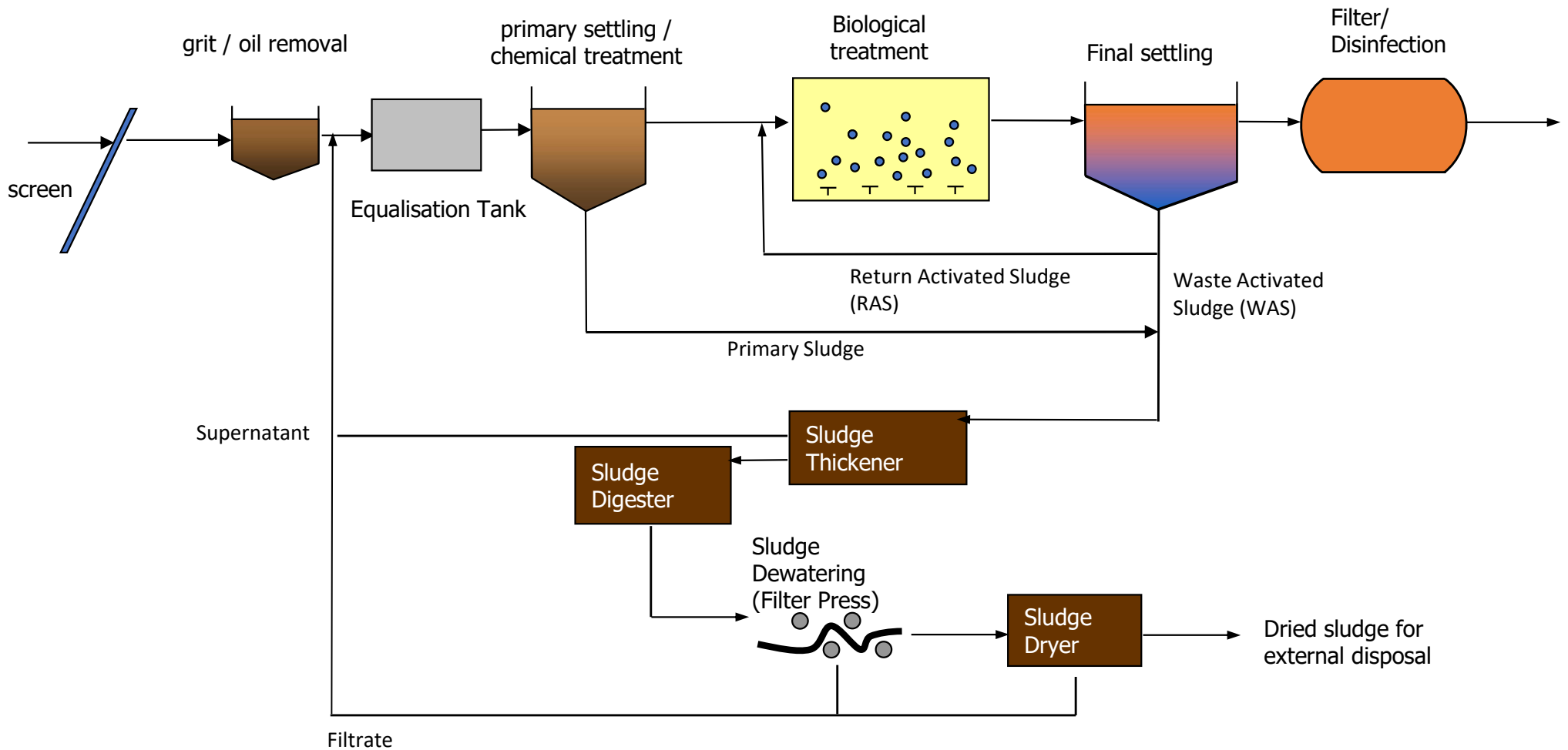




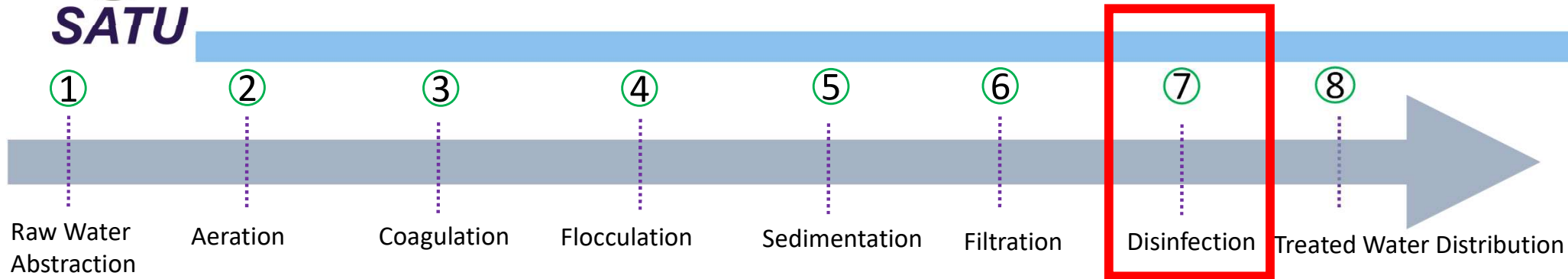
SHARING SESSION
DISINFECTION USING ELECTRO-CHLORINATION
DEPT OF OPERATION (PRODUCTION SECTION)
DATE: 14TH AUGUST 2023



Water Treatment Process Flow



Water Treatment Process Flow



No	Process Unit
1	Raw Water Abstraction-Coarse Screen, Sand Ejector, Pumpsets, Surge Suppression System
2	Aeration-Cascade Aerator (pH Correction, KMnO ₄), Air Diffusion Aerator (pH Correction, KMnO ₄)
3	Coagulation-Mixing with Poly Aluminium Chloride (PAC), Aluminum Sulphate (Alum)
4	Flocculation-Baffle Wall type (Timber or Concrete Type), Mechanical Flocculator
5	Sedimentation-Horizontal Flow Tank, Plate Clarifier Tank with Scraper
6	Filtration-Single Media, Rapid Gravity Sand Filter with false bottom slab, Dual Media, Rapid Gravity Sand Filter with lateral pipe
7	Disinfection-Chlorination (including Fluoridization & pH Correction)
8	Treated Water Distribution to Users

Filtration

- To **remove** suspended matter **NOT** removed during sedimentation process

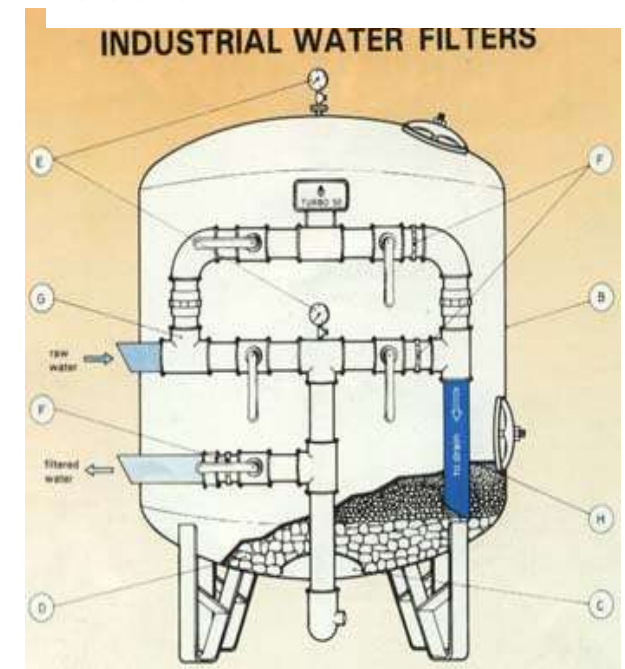
Single Media Filter



Dual Media Filter



Triple Media Filter



Filtration

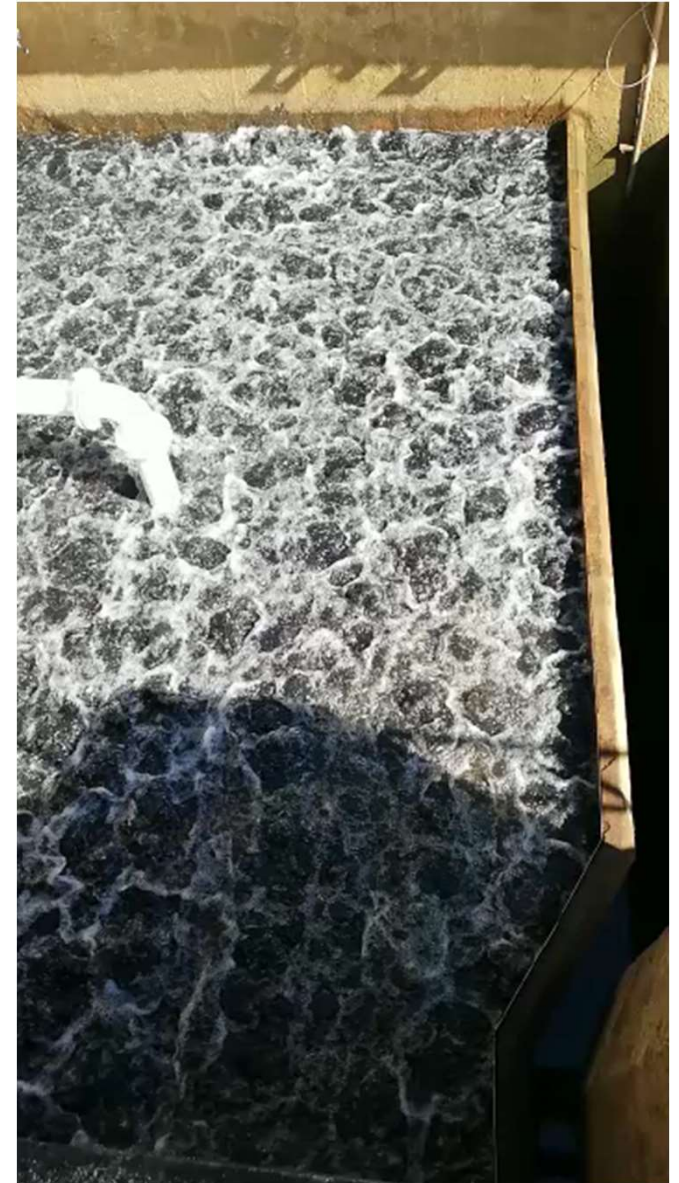
- Dual Media Rapid Gravity Filter-Anthracite & Sand



Filtration

- **Backwashing of Dual Media Filter**

1. Water Rinsing 7 Minutes
2. Air Scour for 1 Minute
3. Water Rinsing 7 Minutes

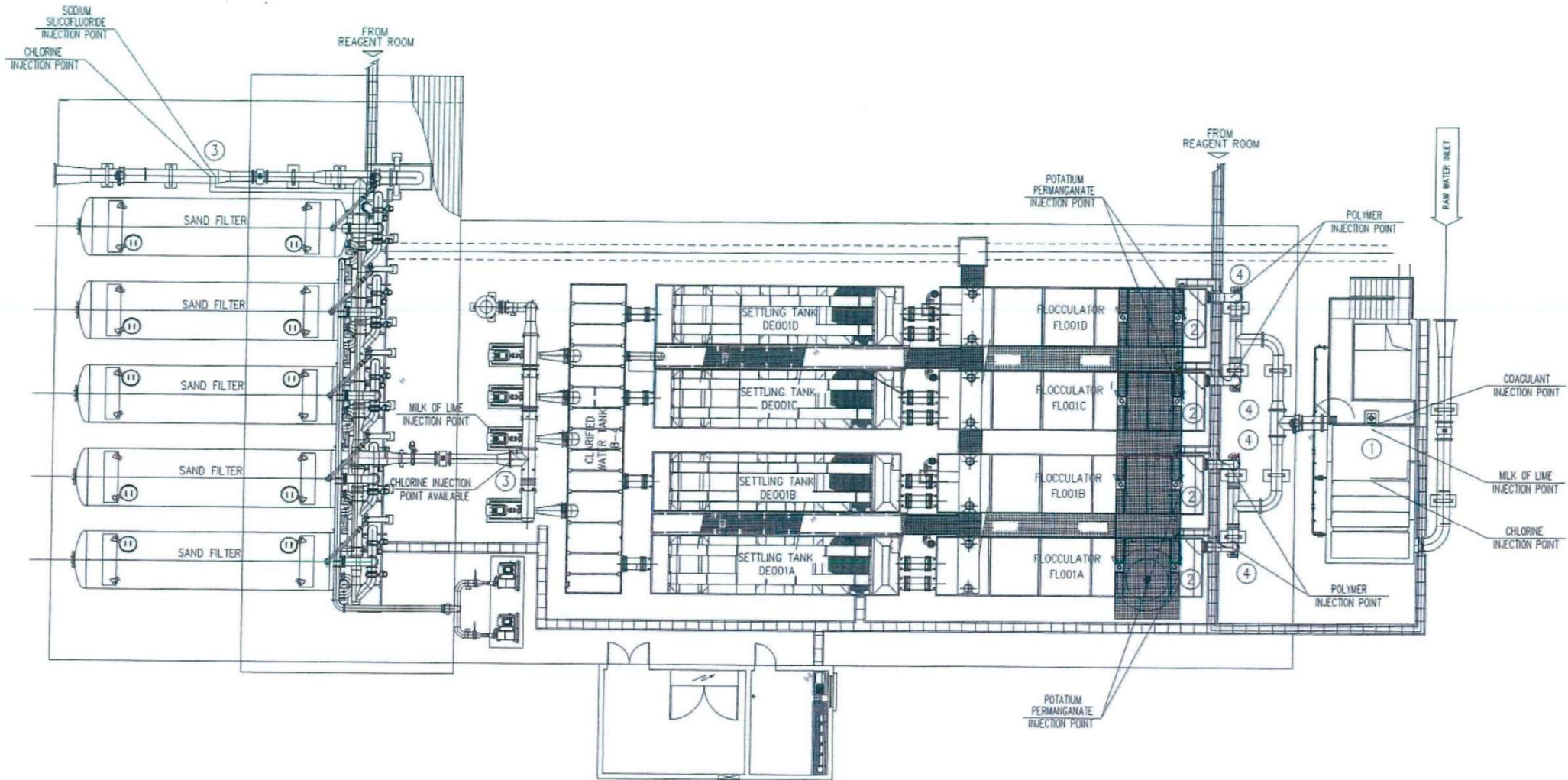


Filtration

- **Pressure Filter**



Filtration

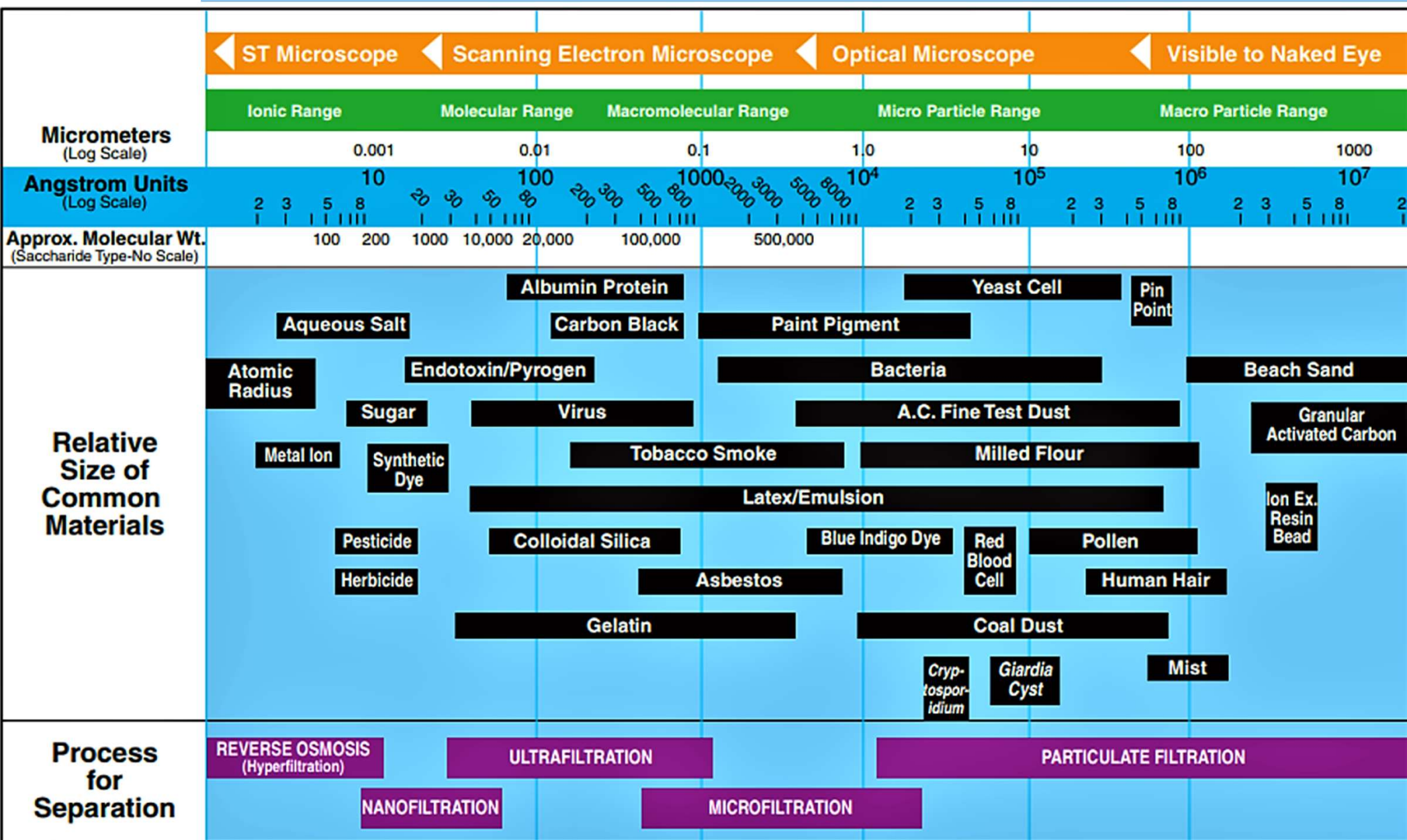


Filtration

- **Membrane Filter-Microfiltration**

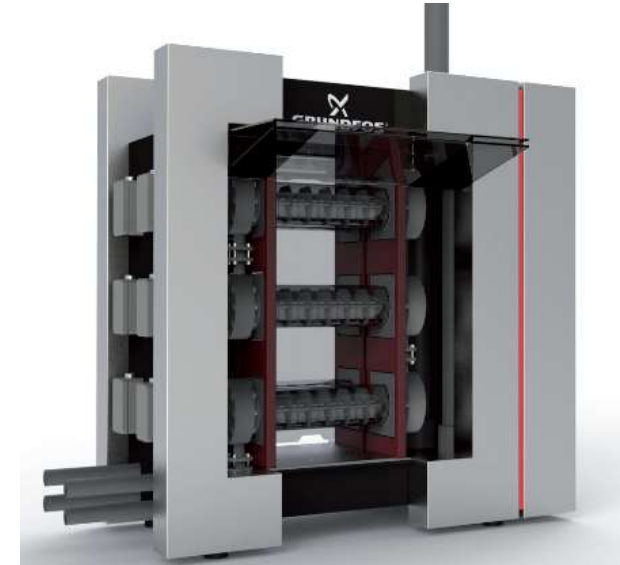


Filtration Spectrum



Disinfection

- **Disinfection**-To remove **pathogen** from treated water. Pathogen available in untreated water:
 - Bacteria
 - Virus
 - Protozoa
- Disinfection methods:
 - Gas Chlorination, Cl_2
 - **Electro-Chlorination**, NaOCl
 - Chlorine Dioxide, ClO_2
 - Ozonation
 - Ultraviolet (UV) irradiation



Electro-Chlorination



UV Irradiation



Gas Chlorination



Ozonation



ClO_2

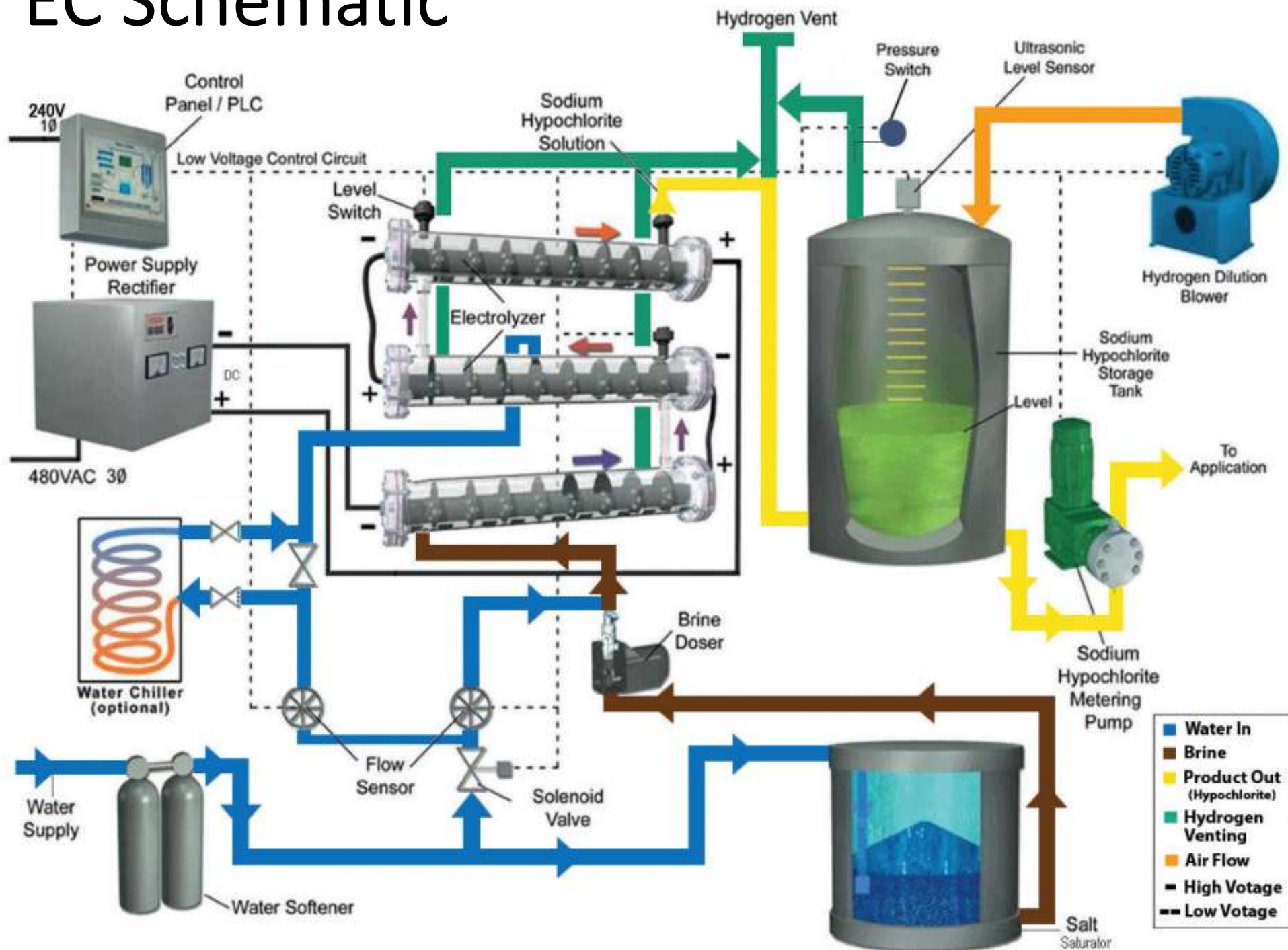




NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETRE AND LEVELS ARE IN METRE UNLESS OTHERWISE STATED.
2. WALL AND SLAB THICKNESS IN INDICATIVE ONLY. ACTUAL THICKNESS, PLEASE REFER TO STRUCTURAL DRAWINGS.

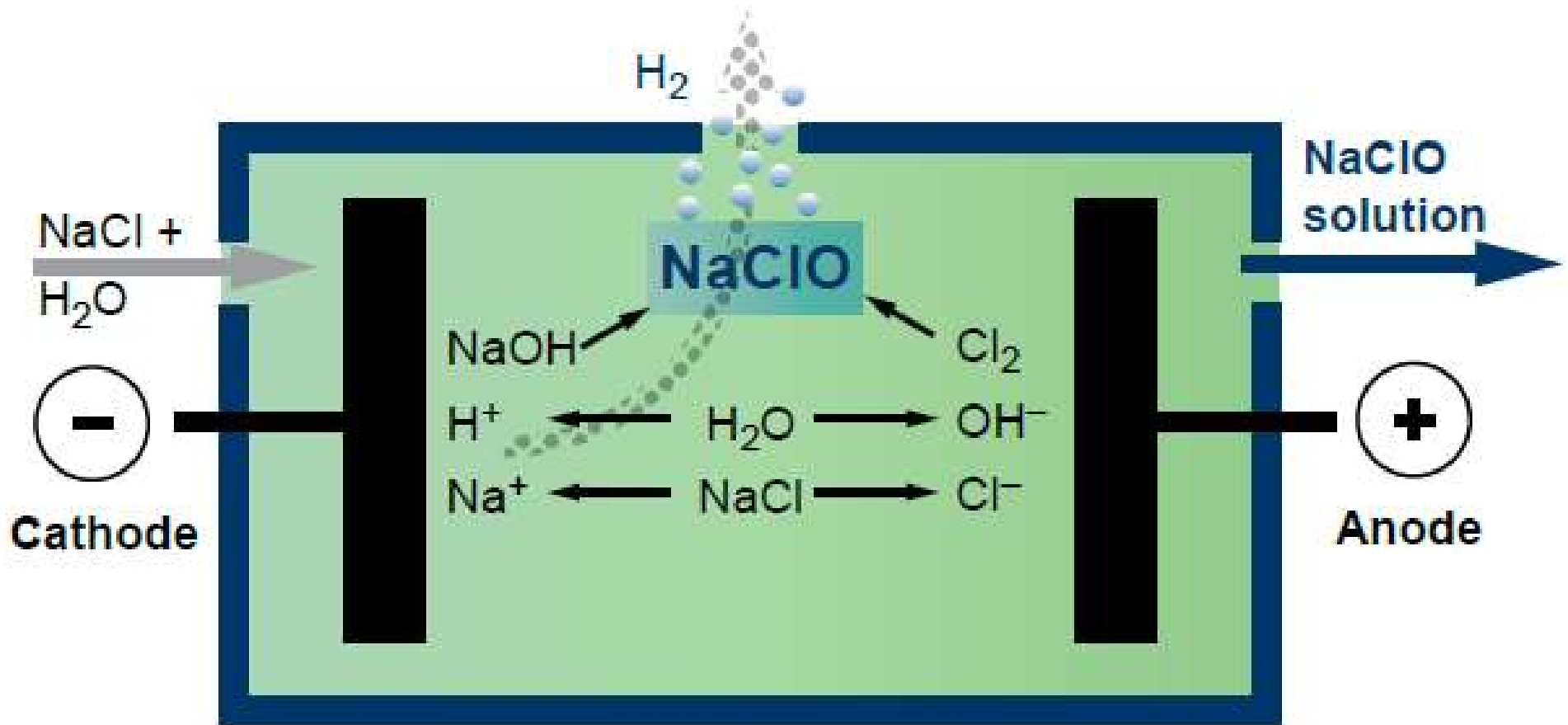
EC Schematic

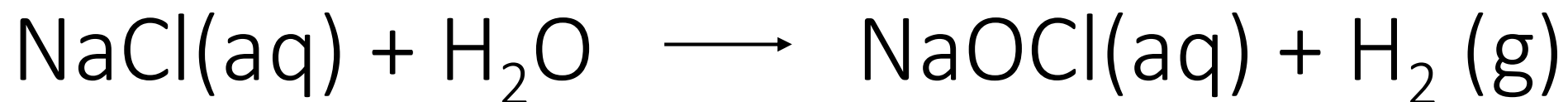


Electrolyzer Skid



Electrolysis of Brine





CAPEX and OPEX



chlorine gas

- Low CAPEX for a turnkey system
- Low OPEX (pH value of < 7.5)

Example OPEX:
1000 kg drum of chlorine is about 750 USD in Malaysia:
-> 1kg of chlorine is **0,75 USD**



electro chlorination

- CAPEX for a turnkey system is about 2-3 times higher than for a chlorine gas system
- OPEX depends on the consumption and price of salt and electricity but is approx. 2-3 times higher than for chlorine gas

Example OPEX:
0.23 USD / kg salt
0.13 USD / kWh electricity

For 1 kg chlorine equivalent:
 $3.5 * 0.23 \text{ USD} + 5.4 * 0.13 \text{ USD} = 1.52 \text{ USD}$
-> 1kg of chlorine is **1.52 USD**



chlorine dioxide

- CAPEX for a turnkey system is on a similar level like a chlorine gas system
- OPEX is higher than for chlorine gas (about 5-7 times) and electro chlorination

Example OPEX:
0.86 USD / kg 25% NaClO₂
0.50 USD / kg 31% HCl

For 1 kg ClO₂:
 $7.1 * 0.86 \text{ USD} + 5.7 * 0.50 \text{ USD} = 8.96 \text{ USD}$
-> 1kg of ClO₂ is 8.96 USD

Considering 2.5 times higher effectiveness: **3,59 USD**