

Ultrapure Water for Electrolysis Unit Operations

Process	Function	Impurity Removal
Mechanical grate	Remove large debris	Solid debris is physically removed from the grate to be disposed of
Raw water intake	Draw seawater or river water	N/A
Prechlorination and flocculation	Chlorine and $Al_2(SO_4)_3$ precipitate heavy metal ions	Flocs are removed in the multimedia filter bed
Multimedia sand and gravel bed	Remove mud, sludge, sand, algae & flocs	Backwash with air and water
Activated carbon filter	Chlorine and dissolved organic compound removal	Spent activated carbon filter cartridge is replaced and disposed of
Water softening	Replace Ca^{2+} and Mg^{2+} hard water ions with Na^+ ions	Backwash with brine
Low-pressure reverse osmosis (LPRO)*	Remove mono- and multi-valent ions and microbes	Backwash with water frequently, backwash with chemicals occasionally
Pure water buffer tank	Intermediate storage of water	Microbes multiply during storage and ions can dissolve into the water
Electro de-ionisation (EDI)	Polishing to remove traces of ions	Ions build up in the concentrate discharge
Ultraviolet (UV) sterilising lamp	Kill bacteria and other microbes	Dead organisms are removed during ultrafiltration
Ultrafilter	Remove dead organisms	Backwash with water frequently, backwash with chemicals occasionally
Degassing	Remove dissolved nitrogen and CO_2	Gases are vented to the atmosphere
Introduce water to electrolyser water / lye recirculation circuit	Top up water in the electrolyser to enable hydrogen and oxygen generation	Degassing, EDI and filtration may be used in the electrolyte recirculation circuit to remove impurities generated in the electrolyser
EDI and degassing	Pure water purification in the PEM water recycle loop to remove dissolved ions from corrosion and CO_2 from dissolved hydrocarbon decomposition on the electrolyser	As above
Filtration and degassing	Lye filtration to remove precipitated carbonates formed by reaction of CO_2 with lye, CO_2 degassing	Lye filter backwash to water treatment plant

* Thermal desalination may take place here, if required or the reverse osmosis may be operated as high-pressure sea water reverse osmosis (SWRO or HPRO) if desalination is required