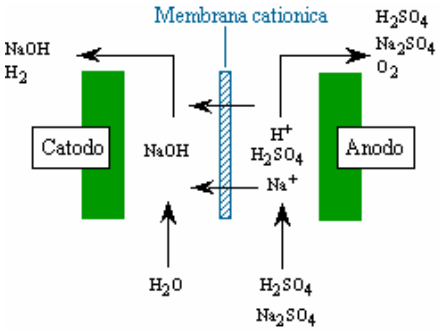
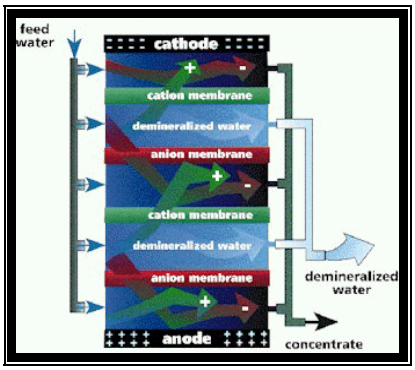
Electrodialysis

Working principle

The dialysis operation allows to separate some from others dissolved molecules by permanent membranes. As a general rule the separation takes place since the dialysis membranes are characterized by micropores with such dimensions that only some dissolved molecules can pass through. The process can be speed up by means of a DC voltage application: in this way the ions are pressed to migrate in the direction of opposite charge electrode.



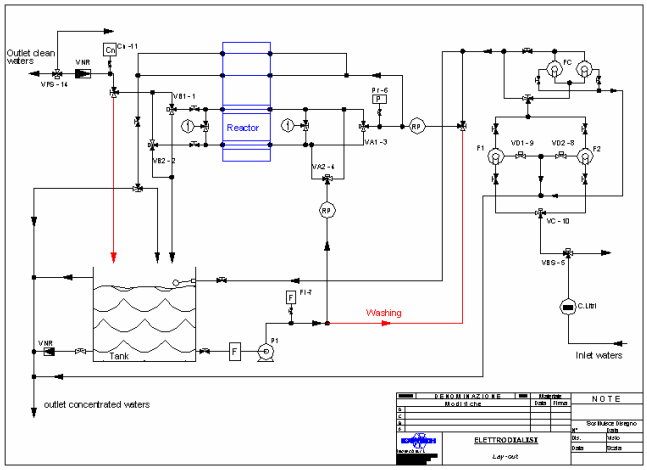
The ions movement can be controlled by the addition of ion exchange membranes that form watertight compartments. In the electrodialysis process are utilized two types, both electrically conductive and water impermeable, of ion exchange membranes, just the anionic membranes that allow only negatively charged ions to pass through and the cationic membranes that allow only positively ions to pass through.
To minimize the organic and inorganic fouling of the membranes are normally applied several technologies, as for example the pretreating of the feeding waters (prefiltration), the optimization of the working conditions, (solution pH control, flow speed and turbulence into every cell), the polarity reversal after a specific interval of time.
The last technology, named reverse electrodialysis (EDR) is an optimization of conventional process.
In EDR system the electrode polarity reversal enable continuous processes for water demineralization without any chemical additive.



Performance

- Cost of treated water proportionate to total dissolved solids (TDS) content
- Salt removal for any hydraulic stage about 40-60 %
- Electrolyte backspread minimized by very fine chemical potential gradient
- Preliminary removal of turbidity, of Fe, Al, (<0,3 ppm) and Mn (<0,1 ppm) ions to avoid the growth of undissolved precipitated (Ca Co_3, Mg $(OH)_2$) on membrane surfaces
- Efficient hydrophobic protection provided by pre-treating the surface of the membrane with a special polymer functionalised with groups able to satisfy the species present on the surface of the membrane in stable manner. This way a “macromolecular” structure is created disposed in an extensive arrangement so as to maximise the number of saline bonds made: thus organised the protective macromolecules turn their hydrophobic side towards the watery solution and so prevent the deposition of the organic substances.

EDR overall view



EDR lay-out

System component

- filtering system of incoming water composed of 2 filtering stages
- motorised flow distributor valve group
- internal self-recirculation pump
- tank for self-recirculation water
- reactor composed of polymeric membranes subjected to protective treatment
- electric power supply panel of the membrane packs and system control PLC in cupboard integrated with the system
- aluminium support structure with removable aluminium coverings

Technical-functional data	EDR5	EDR10
Water treatment capacity	5.5 m^3/h	11 m^3/h
TDS to be removed min	90 %	90 %
Discharge clarified water	5 m^3/h	10 m^3/h
Membrane stacks	N°100 cationic membranes	N°150 cationic membranes
	N°100 polypropylene spacers	N°150 polypropylene spacers
	N°100 anionic membranes	N°150 anionic membranes
Power used	4 kW	6 kW
Dimensions	2000 x 2000 x 2500 mm	2000 x 2000 x 2500 mm

EDR detail of membrane packs

EDR installation phase