ULTIMATE

WATER SMART INDUSTRIAL SYMBIOSIS

TRANSITION FROM LINEAR TO CIRCULAR ECONOMY

in the nexus of the water sector & intensive water consuming industries.

Electrodialysis (ED)

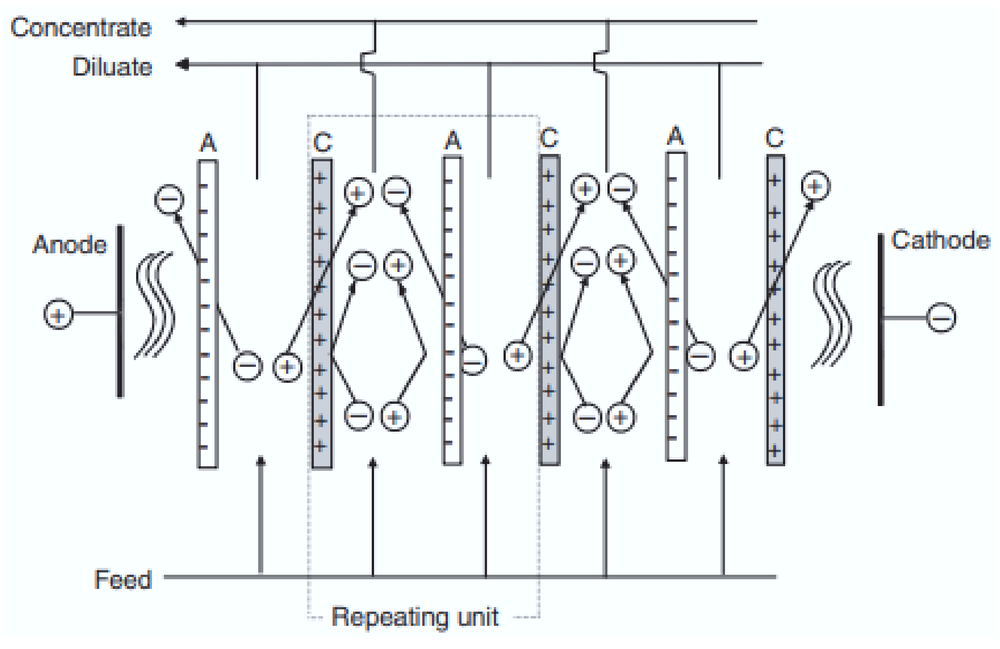

Fig 1. Electrodialysis process diagram. (Source: H. Strathmann, (2010))

Description

Electrodialysis (ED) consists of a series of alternating anion- and cation-exchange membranes (AEMs and CEMs) between an anode and a cathode.

For an ionic solution when electrical current is applied, positively charged cations move towards the cathode and negatively charged anions toward the anode.

Cations pass through the negatively charged CEMs but are retained by the positive AEMs and vice-versa. Resulting in alternate concentrate and diluate (depleted ions) compartments.

Unique selling points

- Selective ion separation
- High product recovery
- No phase change, lesser energy input
- Limited chemical requirement
- Development of novel IEMs

Applications

General System Design

Parameter	Range
Cell Pairs	<10 (bench) - 100s (pilot/full)
Membrane area	0.01 – 0.06 m^2/membrane
Flow velocity	<1-10 (upto 50) cm/s
Applied voltage	7-30 V (lab scale)
Current density	5 - 400 mA/cm^2 (lab scale)
Capacity	<1 - 20,000 m3/day
Geometry	Sheet flow or tortuous path, Continues or batch mode
Recovery potential	Upto 22 mg L^{-1} N, 40 mg L^{-1} P (secondary effluent), upto 85% (industrial wastewater)

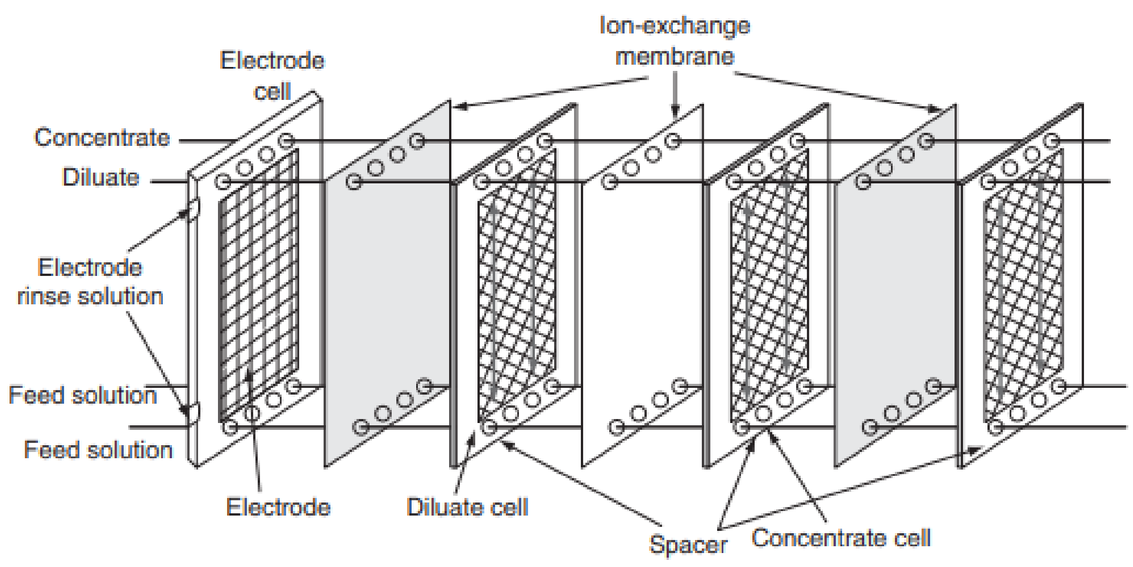

Fig 2. Electrodialysis stack cross-section. (Source: H. Strathmann, (2010))

Source: (Sajjad Al-Amshawee, 2020), (Rubaba Mohammadi, 2021), (Gurreri L, 2020)

Applications in Industrial Symbiosis

- Water and nutrient recovery for horticulture industries
- Industrial water reuse - water from crude oil
- Resource recovery from wastewater - nickel, cadmium, and copper
- Cost competitiveness - recycling of cooling tower blow-down water

Limitations

- Not many pilot scale studies
- Desired selectivity
- Membrane fouling
- Costs

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