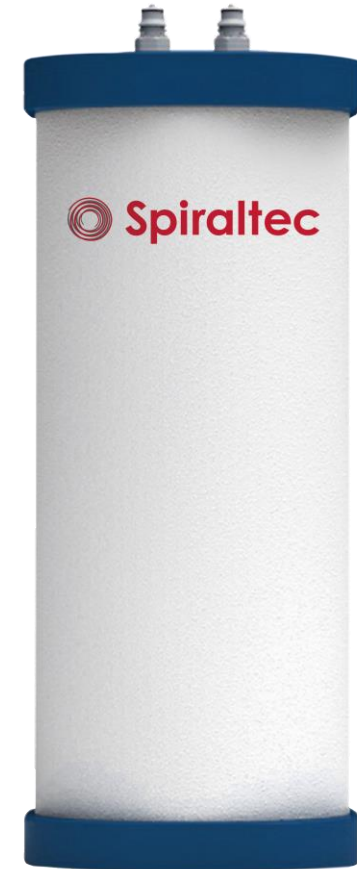




Circular Economy in Surface
Treatment of Aluminum by
Using Diffusion Dialysis
Technology of Spiraltec



Circular economy

The circular economy is a **model of production and consumption, which involves a.o. reusing, and recycling existing materials and products as long as possible.** In this way, the life cycle of products is extended. In practice, it implies reducing waste to a minimum.



Contribution to the Circular economy by Spiraltec technology

In the surface treatment of aluminum, different chemicals are used (i.e. sulfuric acid, hydrochloric acid or caustic soda).

Spiraltec technology, can recover the mentioned chemicals from wasted treatment solutions, enabling reusing valuable components, which otherwise would have been disposed of.

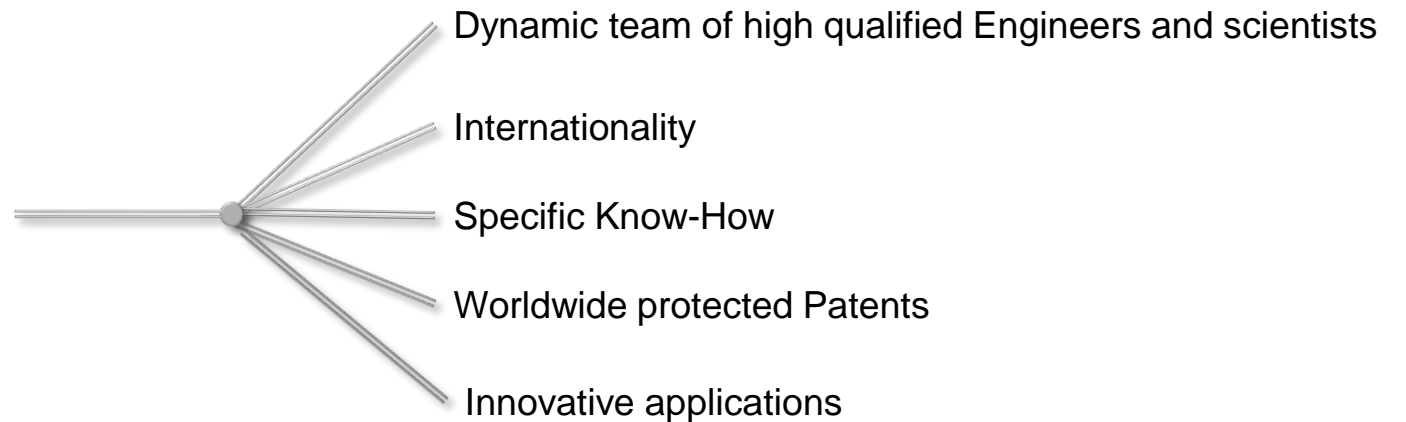


SPIRALTEC GMBH

Spiraltec GmbH manufactures as the first company in the world Spiral Wound Modules for Diffusion Dialysis .

Competences of Spiraltec GmbH

■ Made
■ in
■ Germany



Diffusion Dialysis

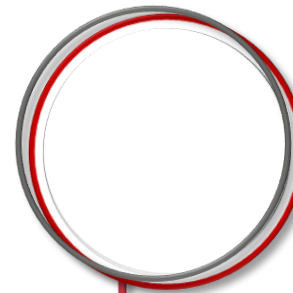
The principle is based on opposite flows of two different fluids through two chambers, which are separated by a semipermeable membrane.

In simplified terms a substance is transported from the concentrated fluid to the diluted fluid until the difference in concentration is balanced.

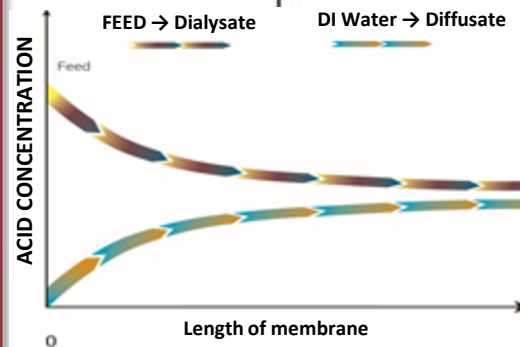
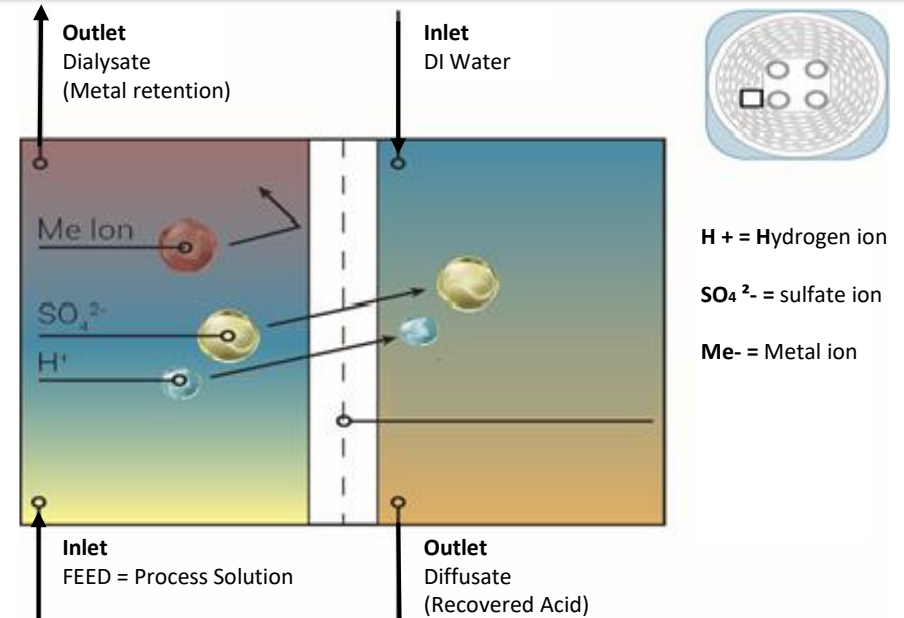
The selective membrane retains certain components from the concentrated fluid and enables the desired separation. This effect is known as the Gibbs-Donan effect and describes the behavior of ions in presence of a permeable membrane.

- **Up to 90-95 % Acid recovery**
- **Up to 75 % recovery of caustic soda**
- **Up to 98 % Metal retention**

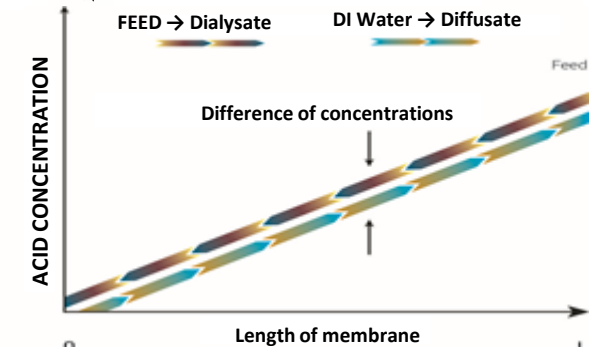
recovery rates depend on the flow volumen and on the specific application.



Example of acid diffusion dialysis



Flows in same direction allow only a 50 % recovery of acids



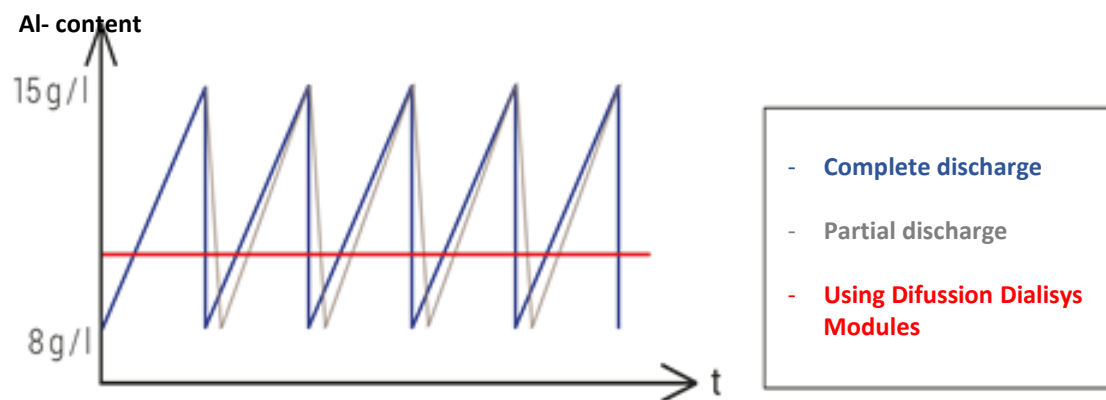
Flows in opposite directions allows a maximal recovery of acid



Spiral Diffusion Dialysis Module of Spiraltec

Compounds recovery in the Aluminum surface treatment:

- Acid Recovery
- Caustic soda recovery
- retention of metals within metal surface treatments.



Our DD-Moduls allow a continuous treatment of process feeds. Our equipment is easily scalable thus suitable for different process volumes.

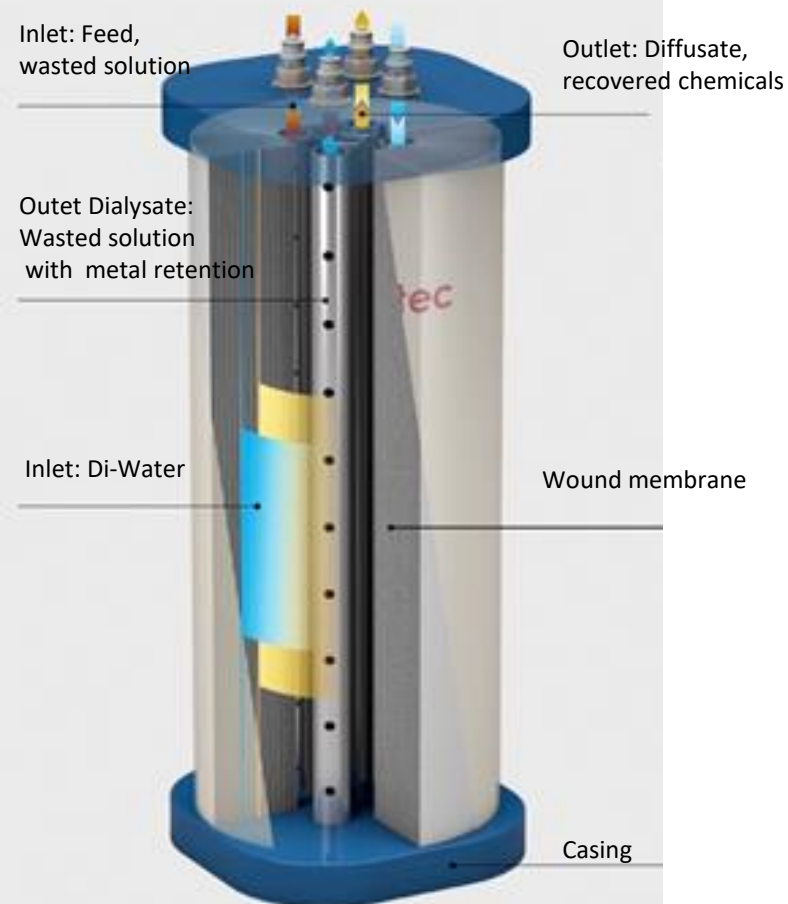


We manufacture standard equipments.

We can design a taylored equipment according to your parameters.

You can just acquire the modules and integrate them in your system.

Diffusion Dialysis Module of Spiraltec



Strong performance

- Up to 90-95% acid recovery*
- Up to 75% recovery of caustic soda *
- Up to 98% Metal retention / recovery

*depends on volume flows ratios and compound's concentrations

Affordable

Through an optimized design the DD-Module can be manufactured cost-effectively. Allowing more membrane area in a reduced space.

Compact design

Each Module DD-Module can process up to 20 l/h Feed (depending on Membrane area)

Standard dimensions: 0,2 m x 0,6 m or 0,27m x 0,6m

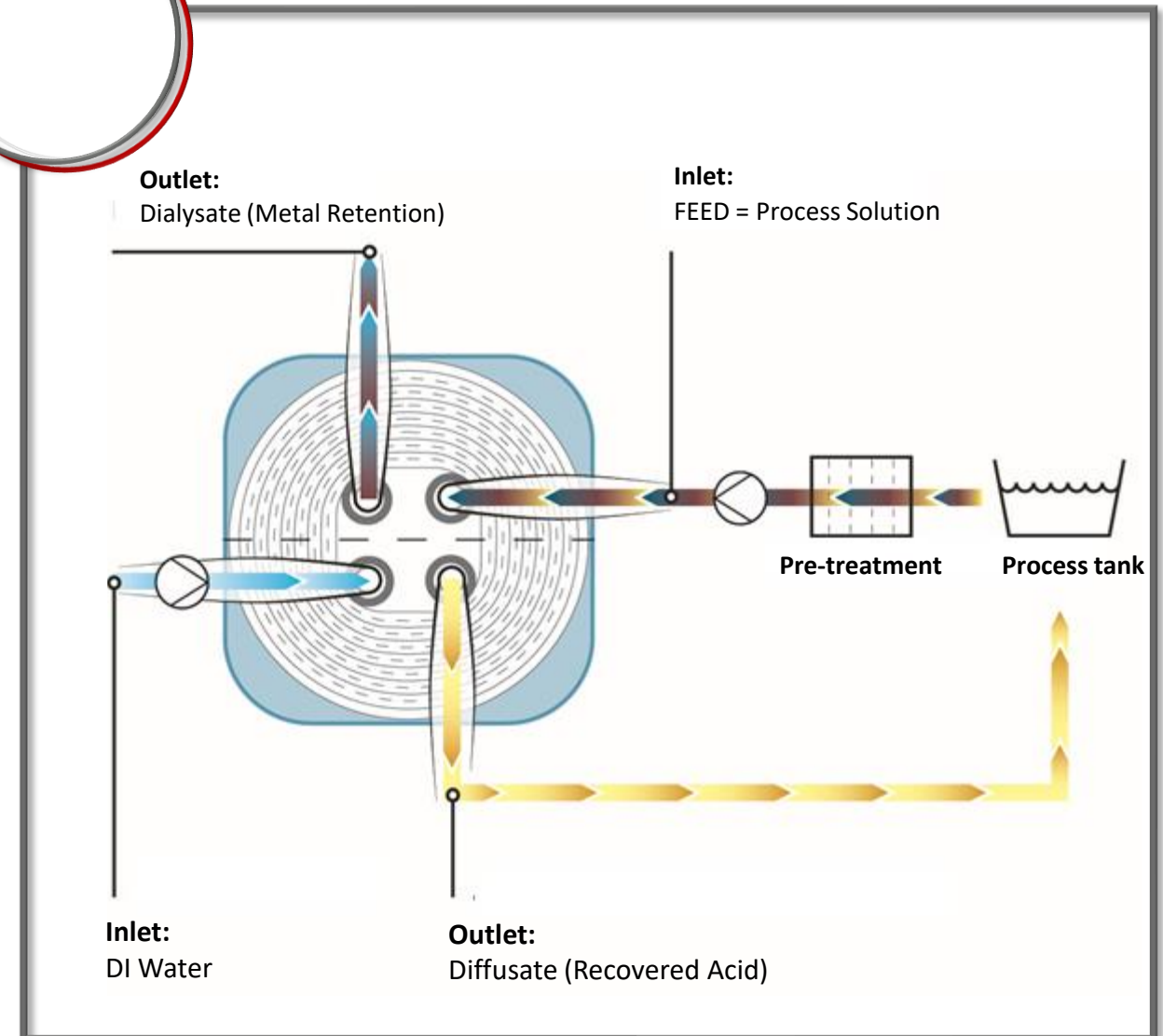
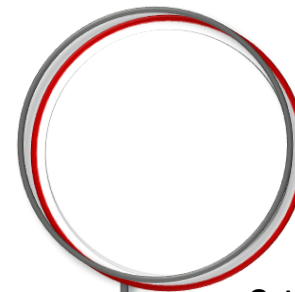
Increased performance parameters and compact system technology compared to i.e. the previously used plate stacking technology make the spiral membrane module extremely attractive

SPIRAL WOUND DD MODUL

All known membrane separation processes could only be successfully industrially implemented with the transition from a flat geometry to a tube geometry.

Increased performance parameters and compact system technology compared to i.e. the previously used plate stacking technology make the spiral membrane module extremely attractive.

Flow:	5 - 15 l/h each channel
Pressure loss:	80 mbar (at 5 l/h) - 400 mbar (at 15 l/h)
Operating pressure:	0.1 - 1.5 bar (overpressure)
Differential pressure:	< 200 mbar (between the channels)
Operating temperature:	5 °C - 30 °C
Empty weight:	Approx. 8 kg
Fill volumes:	Approx. 4.5 l each channel
Mounting:	Only vertical, connections upwards (see installation instructions)
Media connections:	Inside thread 3/8", with CPC quick-couplers as an option





Areas of application in the surface treatment of Aluminum

Recovery of acids

Recovery of caustic soda



Sulfuric Acid

Aluminum
Anodizing

70-95 % Recovery



Hydrochloric Acid

Aluminum
Pickling

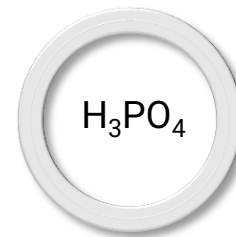
Up to 92 %
Recovery



Nitric Acid

Aluminum
Etching

Only in
combination with
 H_2SO_4



Phosphoric Acid

Aluminum
Chemical
polishing

Up to 80 %
Recovery
(Not in combination
with strong acids)



Caustic soda

Aluminum
Pickling

Up to 75 %
Recovery rate.

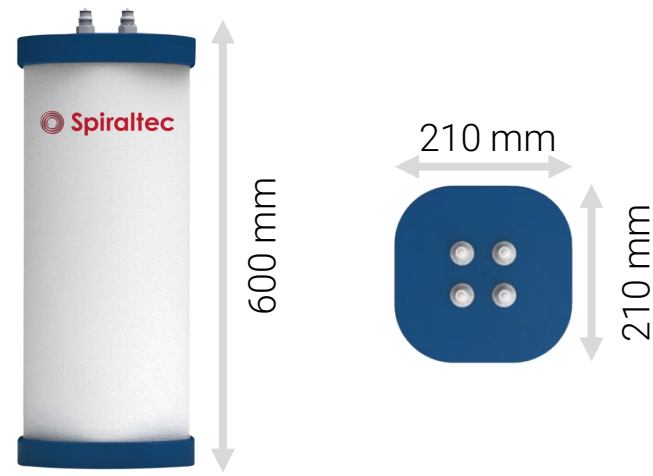
Recovery rates depend on the specific condition of the wasted solution, like presence of other compounds, concentrations, etc.



Acid washed solutions: Boundary conditions

SPIRAL WOUND DD MODULE

WD-AR10



Boundary Conditions:

- No organic materials (Pre-filtering required)
- Particle removal $\geq 10 \mu\text{m}$
- High Acid concentrations limit diffusion
- Avoid oxidants.
- Avoid Complex metal ions.

- Compact
- Easy change
- Continuous process

MORE ADVANTAGES

DD-Module technology and Al - surface treatment lines



- Continuous operation
- Extension of life span of process baths
- Consistent electrolyte quality
(Avoidance of a sawtooth curve)
- Consistent surface quality
- Energy savings
- Chemical savings / recovery of valuable compounds
- Saving of neutralizing agents
- Reduction of landfill costs

APPEREANCE & SIZE

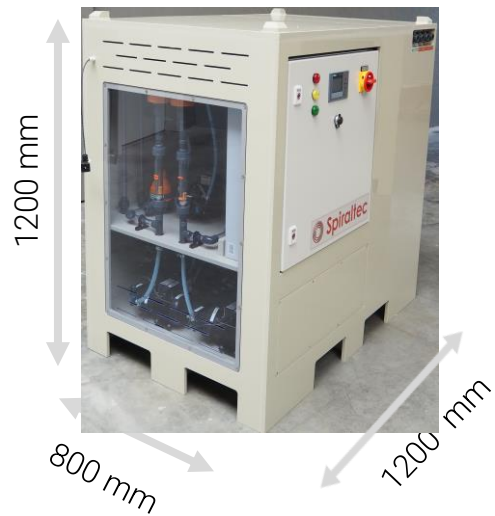
SOME SPIRALTEC EQUIPMENTS



DDSU150-02

2x DS10-30

Complete DD equipment



Conclusions

- Spiraltec DD-Modules technology contributes to the consolidation of the circular economy
- Affordable and effective process enables the recovery and re-use of chemical components from wasted process solutions
- Reduction in production costs
- Reduction of costs in neutralizing agents in waste water treatment plants
- Reduction of the environmental impact reducing the amount of disposed chemicals
- Through the continuous operation of Spiraltec systems, surface quality can be steadily maintained, reducing scrap and rejections

CONTACT

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THANK YOU VERY MUCH!!!

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