



SEPARATION

THE KEY TO EFFICIENT ZERO-LIQUID DISCHARGE (ZLD)

A WIDE SELECTION OF SOLID/LIQUID
SEPARATION TECHNOLOGIES

ANDRITZ

ENGINEERED SUCCESS



**OPTIMAL
WATER REUSE**

**REDUCED
ECOLOGICAL
FOOTPRINT**

**VALUABLE
BY-PRODUCTS**

“Solid/liquid separation is the crucial step in any ZLD installation. Our cutting-edge technologies ensure that the goals of the ZLD process are achieved in the most efficient way. We are proud that our extensive know-how in this field makes a significant contribution to this exceptional, environmentally friendly process.”

FRANÇOIS FEVRIER

Business Development Director Chemicals, ANDRITZ Separation

Maximum efficiency for your zero-liquid discharge (ZLD) process

Due to the scarcity of global water resources and the ever increasing need to protect the environment, zero-liquid discharge is becoming more and more important. ANDRITZ was active in this field long before “ZLD” became the buzzword it is today. As the world’s leading separation specialist, we have a proven track record in dewatering solutions and offer the broadest technology portfolio on the market. We are, therefore, the ideal partner for any ZLD project.

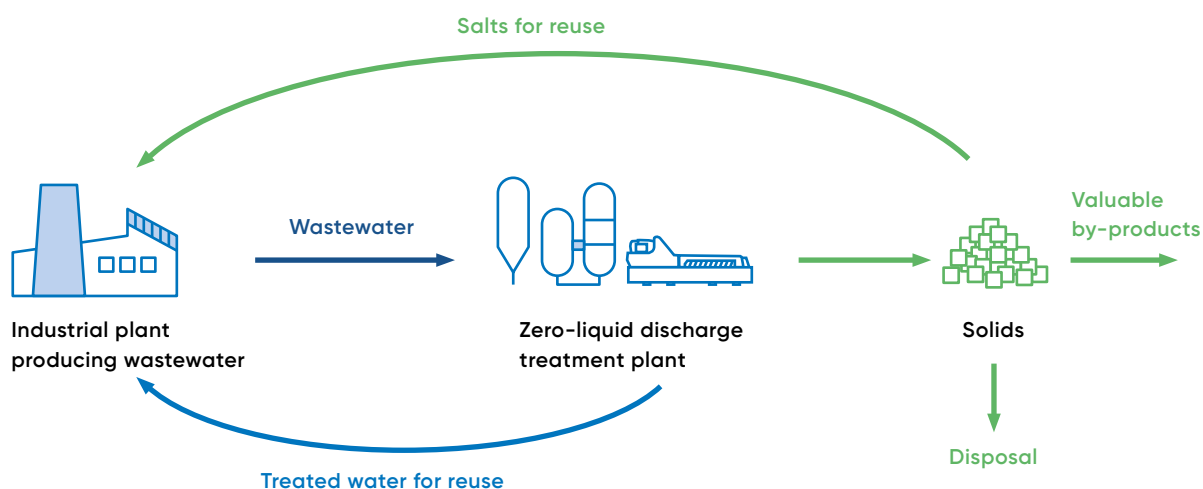
THE BENEFITS OF ZLD

In the past few years, ZLD has become a popular way to increase the environmental sustainability of industrial plants in a wide variety of different sectors – from the production of chemicals, oil and gas, to the generation of energy. Particularly in regions with a short supply of fresh water, this innovative method has proven to be of great value.

ZLD not only reduces the ecological footprint of a plant by eliminating wastewater discharge, but also increases water reuse and allows for the recovery of valuable by-products. In this way, it helps companies to meet stringent wastewater disposal regulations as well as water reuse guidelines, and also improves their public image.

THE IMPORTANCE OF SOLID/LIQUID SEPARATION

For the efficiency of each ZLD installation, the last step is crucial: Solid/liquid separation. This is where the precious water is separated from the solids. For each milligram of solids remaining in the water and each percentage of water remaining in the solids, a price has to be paid, either by the plant operator or the environment, or in most cases by both.



Zero-liquid discharge (ZLD) is an effective method to eliminate wastewater discharge, recycle water, and recover valuable solids and chemicals.

Ensure that zero means zero with ANDRITZ technologies

ANDRITZ is your technology provider for reliable dewatering solutions that help you achieve the highest efficiency levels in zero-liquid discharge. Our extensive portfolio includes pusher centrifuges, decanter centrifuges, and filter presses that are ideally suited for ZLD processes and can be perfectly matched to your individual needs. What's more, we also offer thermal drying systems, pumps, and other utilities.

YOUR ZLD SPECIALIST SINCE 1990

Looking back on 150 years of experience in solid/liquid separation and at least 60 years in the handling of saturated brines, ANDRITZ provides an unrivaled portfolio of state-of-the-art separation technologies for ZLD applications. Since 1990, we have installed a large number of pusher centrifuges, decanter centrifuges, and filter presses as part of ZLD systems, supporting customers from almost all branches of industry.

Moreover, ANDRITZ is also a specialist in industrial wastewater treatment. We provide a comprehensive selection of water conserving and water recycling solutions based on the unique design of screens, continuous sand filtration technologies, belt presses, centrifuges, and separators.

THE RIGHT SOLUTION FOR EVERY CHALLENGE

Each ZLD process and each customer has specific requirements. As ANDRITZ offers a wide range of ZLD-specific products and variants, our experts are able to select the best system for your individual application. As a result, you can profit from a well-proven solution that allows you to achieve the required product recovery rates with the highest possible energy efficiency. In addition, our systems come with a low-maintenance design, which further reduces the total costs.

ANDRITZ operates fully equipped test centers close to its customers, offering both lab-scale and pilot-scale equipment. Our experienced separation specialists will advise you in detail and help you find the best suited technologies from our wide portfolio. Thanks to our experience with highly corrosive and abrasive environments, you can rest assured that our specialists will choose the right alloy for your equipment.

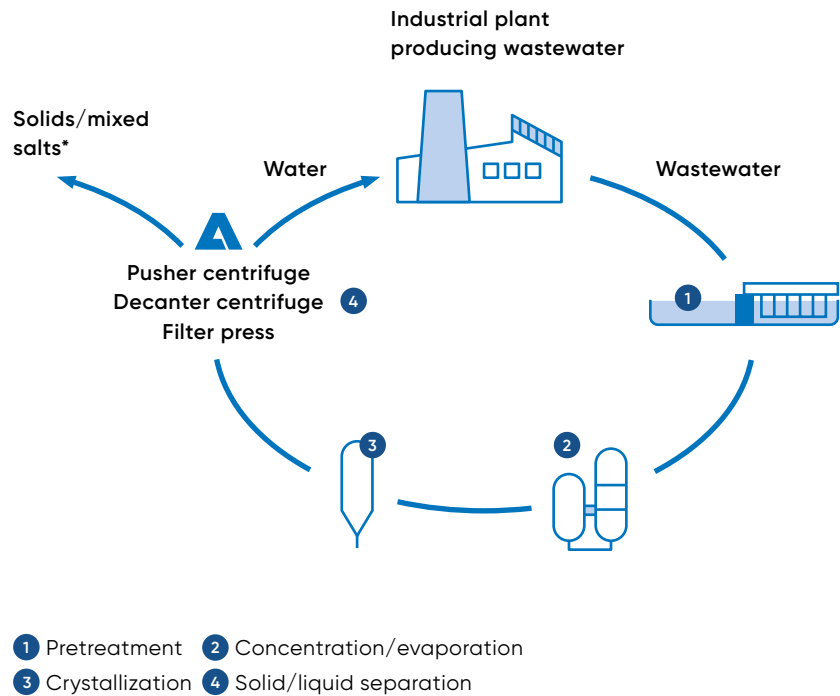
YOUR ADDED VALUE WHEN WORKING WITH ANDRITZ

- Maximum separation and filtration efficiency while preserving the size and structure of the crystals to enhance overall efficiency
- Broadest technology portfolio for ZLD-specific solid/liquid separation processes, including large-scale machines such as decanter centrifuges with a diameter of 1,100 mm
- Optimized product solutions based on decades of experience in operating and servicing our equipment in ZLD processes
- Process specialists and in-depth know-how of the right metallurgy for every ZLD application
- Cost-efficient solutions with high energy efficiency and low lifecycle costs
- Proven performance based on reliable technology, ensuring smooth operation with low energy consumption
- Increased productivity with advanced Metris addIQ control systems (see page 10)
- Full service provided worldwide and fast delivery



TYPICAL ZLD PROCESS

In the pretreatment step, the waste stream is conditioned and easy-to-remove waste and chemicals are filtered or precipitated. In the second step, the waste stream is concentrated using reverse osmosis for example and/or evaporation, depending on the process. In the third step, the concentrated waste stream is fed to a crystallizer, where the crystals are formed. The waste stream now consists of crystals suspended in water. This stream is fed to the solid/liquid separation system, which is the crucial part of the process. No matter how efficient the previous steps were, the overall efficiency is decided here. For each milligram of solids remaining in the water and each percentage of water remaining in the solids, a price has to be paid, either by the plant operator or the environment.



- 1 Pretreatment 2 Concentration/evaporation
- 3 Crystallization 4 Solid/liquid separation

* For example, NaCl, Na₂SO₄ or KCl. The salts are partly dumped and partly reused.

INDUSTRIES

- Chemicals
- Oil, gas, and refineries
- Metals and mining
- Pulp and paper
- Energy production
- Environment

APPLICATIONS

- Cooling water blowdown
- Wastewater from coal-fired plant
- Scrubber effluent
- Non-ferrous loaded effluent
- Water loop desalination
- And many more



Pulp mill of an ANDRITZ customer in Brazil

The right dewatering solution for any challenge

There is not just one process for zero-liquid discharge, but many different variants. With ANDRITZ at your side, you are well equipped to meet all possible requirements. Thanks to our broad range of solid/liquid separation technologies, you can rest assured that you will have the right system for your process and always have equipment that is perfectly adapted to your process conditions.

HIGH CORROSION RESISTANCE

In a ZLD system, corrosion is a big issue: Operating temperatures are typically above 80 °C and can reach up to 135 °C. In addition, chloride concentration is often high. In order to tackle these challenges, we use selected and well-proven high-grade alloys such as duplex and super-duplex stainless steels or even more specialized materials, avoiding corrosion and ensuring smooth operation.

COVERING ALL PARTICLE SIZES

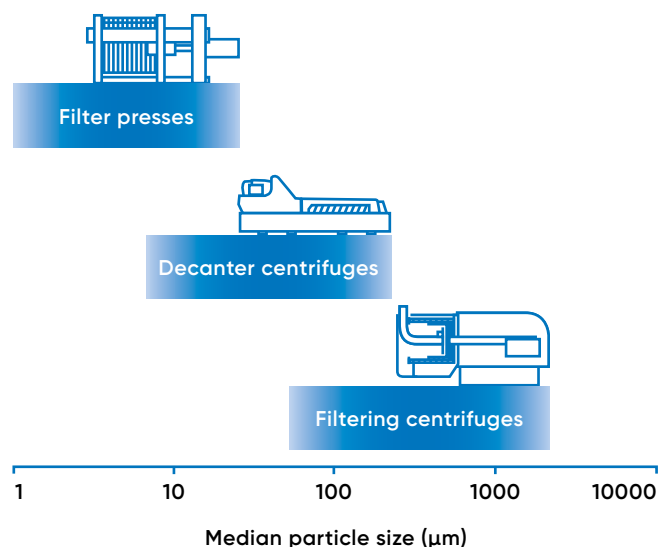
When it comes to the solid/liquid separation stage in ZLD, crystal sizes and throughputs vary a lot from process to process. Hence, the equipment to be used must be selected carefully. The specialists from ANDRITZ assess your process requirements down to the last detail and recommend the best solution for your specific ZLD application.

MEETING THE KEY CHALLENGES OF ZLD

- **Reliability:** Our technologies ensure uninterrupted operations, avoiding corrosion and reducing abrasion to a minimum.
- **Residual moisture:** ANDRITZ helps you to achieve the lowest individual moisture content that is technically possible, lowering the total disposal costs.
- **Particle size distribution:** Our broad portfolio offers the right solution for all typical particle sizes, and we have the best technical solution to preserve the particle size distribution.
- **Environmental sustainability:** ANDRITZ technologies help you meet stringent regulations.
- **Delivery time:** We offer delivery from stock, which translates into very short delivery times.

The extensive ANDRITZ portfolio for ZLD includes pusher centrifuges, decanter centrifuges, and filter presses. All particle sizes typically found in ZLD processes can be covered with these three technologies. While continuous filtering centrifuges such as pusher centrifuges are typically the most economic and efficient choice for crystals with a median diameter of over 100 µm and containing only few fines, decanter centrifuges generally achieve the best result when median particles are in the range of 20 to 100 µm. For particle sizes smaller than 20 µm, filter presses are the best solution.

In addition to salt crystals, other solids (including organic matter) may be present. In centrifuges, the total amount of this other material should be less than 1%. Mixtures with higher organic content are typically handled with filter presses. Our separation specialists evaluate each case individually and choose the best technology for the customers' needs.



The right ANDRITZ solution according to particle size (rough guideline)



Krauss-Maffei pusher centrifuge SZ – the filtering centrifuge for ZLD processes

Pusher centrifuges

Kraus-Maffei pusher centrifuges are the best solution when particles are coarse ($> 100 \mu\text{m}$) and little organic matter is present. They operate continuously, require hardly any operator attention and, due to the unique, patented PreFiltration Technology, they are very flexible towards changes upstream. Pusher centrifuges reach their limits when the particle diameter is too small (rule of thumb: smaller than $100 \mu\text{m}$). That is when our decanter centrifuges pitch in.

CUSTOMIZED DESIGN

Our pusher centrifuges are tailored to your individual requirements. For example, the material of construction is selected according to the operating conditions to ensure high corrosion resistance even during high-temperature ZLD processes. Moreover, we offer a broad range of machine sizes to also meet your requirements in terms of throughput.

Gentle product acceleration in the feed system of the pusher centrifuge avoids crystal breakage and abrasion. In consequence, this prevents an increase in residual moisture due to particle breakage and avoids wear in the feed zone. In addition, our unique, patented PreFiltration Technology allows stable and efficient processing of suspensions, even at low solids concentrations and under fluctuating feed conditions.

YOUR BENEFITS

- Continuously operating, easy-to-use and reliable centrifuge type
- Lowest residual moisture
- Particle loss in filtrate typically below 1%
- Lowest particle breakage
- Easy maintenance

PROCESSING PARAMETERS

| | |
|---------------------------|---------------------------|
| Temperature | up to 135°C |
| Median particle size | $> 100 \mu\text{m}$ |
| Feed solids concentration | 10–70% |

Even the toughest machines have to undergo maintenance every once and a while. However, maintenance of our pusher centrifuges is as simple as it gets because all relevant parts are easily accessible. And if you need support, our service is there to help you.



Decanter centrifuges

When it comes to volatile feeding concentrations and changes in particle size, decanter centrifuges offer maximum flexibility because they can also process fine particles well below 100 µm. Moreover, they operate continuously and require no operator attention.

HIGH VARIABILITY

Decanter centrifuges from ANDRITZ provide a modular system for ZLD applications. You can choose between single and dual drive systems as well as different types of wear protection, greasing systems, materials of construction, and seal systems for the housing. ANDRITZ also offers a special machine series for high operating temperatures of up to 135 °C. All decanter centrifuges have a gentle feeder as standard feature, which reduces crystal breakage and provides a high recovery rate.

PROCESSING PARAMETERS

| | |
|---------------------------|-----------|
| Temperature | 50–135 °C |
| Median particle size | 10–100 µm |
| Feed solids concentration | 2–25% |

YOUR BENEFITS

- Easy-to-operate, continuous systems with simple automation solutions
- High specific throughputs and flexible handling of volatile feed concentrations
- Wide range of solutions thanks to modular system
- Low solids content in centrate



ANDRITZ decanter centrifuge A – the decanter for ZLD processes



ANDRITZ sidebar filter press SE 1500 with rubber lining or PP spray coating – the filter press for ZLD processes

Filter presses

Filter presses are the preferred dewatering solution when you have to remove extremely fine solids that cannot be captured with a decanter centrifuge or when you have to produce solid-free liquids. In addition, filter press technology is used for low-temperature ZLD applications and material mixtures with a higher organic material content (TOC > 1%).

WIDE SELECTION

Filter presses from ANDRITZ have a high level of corrosion protection, which is a key requirement for ZLD. In order to meet your specific process needs, we offer medium-duty, standard-duty, as well as heavy-duty filter presses, and also different degrees of automation. Moreover, we provide special modules that are particularly important for ZLD applications, including high-pressure cloth washing and discharge systems.

PROCESSING PARAMETERS

| | |
|---------------------------|----------------|
| Temperature | 5–90 °C |
| Median particle size | 20 µm and less |
| Feed solids concentration | 1–30% |

YOUR BENEFITS

- High recovery of finest solids: The most economical dewatering technology when low moisture content for finest solids is needed
- High corrosion protection: The automated filter cloth washing device extends the lifespan of the filter cloth and maintains the performance level
- The most suitable dewatering solution to obtain solid-free liquids
- Ideal for feed material with high organic content

Intelligence for machine and process control

With Metris addIQ, you have a well-proven, intelligent control solution for industrial processes and machines. Our solid/liquid separation specialists use their in-depth expertise to provide scalable solutions that are individually tailored to regional and application requirements. Whether you're automating new equipment or upgrading to extend the lifecycle of existing systems, we find the ideal solution for you.

METRIS addIQ CONTROL SYSTEMS

Our tailored turnkey systems from a single supplier can improve entire plants or individual machines. By providing state-of-the-art automation technologies and digitalization, we ensure best-in-class performance. Automating machine and plant equipment measurably reduces gaps in many different production process steps. By using automation from ANDRITZ, you can reduce downtime thanks to features such as predictive analysis that allow you to optimize productivity.

Metris addIQ covers all levels of automation, starting at basic automation (machine, process, and plant control), to upgrades, and add-ons for process optimization. Together, you have a full range of optimized solutions that help reduce maintenance efforts and ensure preventive service for your machines and plants. These are all delivered from a single source and always individually tailored to your business demands. addIQ control systems are part of Metris, the ANDRITZ brand for digital solutions.

ANDRITZ offers a broad and constantly growing range of innovative products and services in the industrial digitalization sector under the brand name Metris, helping customers to enhance plant efficiency and profitability, optimize the use of resources, achieve constant and highest product quality, reduce production downtime, and maximize user-friendliness.



Your full-service provider

With ANDRITZ, you gain access to one of the world's largest OEM manufacturers for solid/liquid separation systems, including such well-known brands as 3Sys Technologies, Bird, Delkor Capital Equipment (Pty) Ltd., Escher Wyss dryers, Frautech, Guinard Centrifugation, KHD Humboldt Wedag, Krauss-Maffei centrifuges, dryers, and filters, Lenser, Netzsch Filtration, Rittershaus & Blecher, Royal GMF Gouda, Sprout Bauer, and Vandenbroek.

Whether you need spare parts, rentals, local service, repairs, upgrades, or modernization of your equipment, ANDRITZ is your true full-service provider. From initial consulting through to service agreements, process optimization, and training programs, we are always looking for ways to minimize downtime and increase

predictability in operations while raising your overall production efficiency. Wherever you operate, our network of 550 service specialists and global service centers ensures we'll always be there to support you for many life cycles to come. Let's sit down and see how we could take your operations to the next level.



LOCAL SUPPORT

Responsive local service centers and field service technicians



REPAIRS & UPGRADES

Optimization of machine and process performance, repair work, retrofitting, and modernization



SECOND-HAND & RENTALS

Certified second-hand and rental machines



TRAINING

Operator training and tailored seminars for operating and maintenance personnel



OEM SPARE PARTS

Filter cloths, spare and wear parts from OEMs or with OEM level quality, all readily available



SERVICE AGREEMENTS

Preventive maintenance, contracts for spare parts, maintenance, inspections, repairs, upgrades, operation, and equipment monitoring



PROCESS OPTIMIZATION

Automation tools and process expertise to boost your profit



LAB AND ON-SITE TESTS

Lab and testing capabilities for process optimization and machine upgrades





WHAT'S YOUR SEPARATION CHALLENGE?

ANDRITZ Separation is the world's leading separation specialist with the broadest technology portfolio and more than 2,000 specialists in 40 countries. For more than 150 years, we have been a driving force in the evolution of separation solutions and services for industries ranging from environment to food, chemicals, and mining & minerals. As the OEM for many of the world's leading brands, we have the solutions and services to transform your business to meet tomorrow's changing demands – wherever you are and whatever your separation challenge. **Ask your separation specialist!**

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