

# Zero Liquid Discharge

"Transform Wastewater Into Value – Zero Liquid Discharge, Infinite Possibilities"

**Innovation | Efficient | Future-Ready**

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"Ionics Low-Temperature-Based Humidification & Dehumidification Technology: The Future of Zero Liquid Discharge"

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 **IONIC**  
Engineering Technology Pvt Ltd





# INTRODUCTION TO IONIC

Ionic Engineering Technologies Pvt. Ltd. is an ISO-9001/2015 certified Indian water and wastewater technology company founded in 2005 with more than 20 years of experience in the treatment and re-use of hard-to-treat waters. We design and offer equipment to operate in the most challenging conditions, offering a cost-effective and environmentally friendly solution by means of our innovative and state-of-the-art technologies. We carry out projects and solutions for Industrial and Municipal Applications, like Pharmaceuticals, Chemical, Cosmetics, FMCG, Aero Space, Automotive, Metalworking, Steel, Refinery and Petrochemical, O&G Upstream, Downstream, Food & Beverage, Pulp and Paper, Sea Water Desalination, etc. to name a few. Our value engineered “Quality by Design” systems are working in several diverse industries for many years and is helping our customers move towards “Cleaner Production”

**Motivation & Vision:** Our main goal is to create value and make a difference for our clients and partners as well as deliver tailored-made solutions to satisfy the requirements of our clients, respecting the environment. At Ionic Engineering Technologies we believe that making water and wastewater reuse an affordable and sustainable water source is essential to the future development of mankind in terms of economy, environment, and society. All our systems are designed and engineered based on sound engineering practice and offer value for money and bring “Peace of Mind” to our customers.

**Why Ionic?** Good advice is half the battle won. Ionic Engineering is a technology neutral company and focused on providing “Quality by Design” engineered systems. We have technology associates based in Europe and USA for some of the cutting-edge disruptive technologies. The first step to the perfect water treatment solution: Understanding your wastewater analysis. We design the plant based on the water analysis sent by our customer.

We are dedicated to using our professional expertise accumulated over many years, to providing the solution you want, when you want it. We also take great pride in ensuring that every client is satisfied with the operating efficiency of the systems we design and the overall level of service that we provide, whether during the initial contract phase or later, throughout the life of the plant.

- Providing expert advice, tailored to meet your requirements.
- Supplying high quality, good value-for-money systems, and equipment.
- Supporting all our clients for the lifetime of their water & wastewater treatment systems.
- Developing and deploying the best, most economic solutions for your needs
- Listen to our customers as well as our suppliers on products and technologies feedback and updates.
- Continuous improvement in all that we do!

Find the best solution for your processes: Let our competent team from the application technology team advise you now! We look forward to hearing from you.

**Customers:** We have many reputed Multinational companies such as Unilever, Coca-Cola, L'Oréal, John Deere, Tata Hitachi, Bajaj, Tata Motors, Century rayon, GACL to name a few as our customers



# Introduction to Zero Liquid Discharge (ZLD)

"No Waste, No Limits: The Power of Zero Liquid Discharge"

## What is Zero Liquid Discharge (ZLD)?

Zero Liquid Discharge (ZLD) is a cutting-edge wastewater treatment technology that aims for the ultimate goal of no liquid waste being released into the environment. Through a series of advanced treatment processes, ZLD systems are designed to recover as much water as possible from wastewater streams, purifying it for reuse while leaving behind only solid waste for disposal.

In industries with high water demand or strict environmental regulations, ZLD is essential for achieving complete wastewater management. By eliminating the need for liquid discharge, ZLD systems contribute to a closed-loop water system, ensuring sustainability and regulatory compliance.

## Why is ZLD Important?

- 1. Compliance with Environmental Regulations** ZLD systems help industries meet the growing demands of environmental laws by preventing the discharge of contaminated wastewater into natural bodies, keeping ecosystems safe. With increasingly stringent discharge regulations across industries like chemicals, textiles, and food processing, ZLD plays a key role in achieving environmental sustainability.
- 2. Prevention of Wastewater Pollution** Conventional wastewater treatment methods often fail to prevent pollution from occurring, as residual liquids are released into the environment. ZLD ensures that no harmful contaminants are left in the liquid discharge, contributing to cleaner waterways and a healthier ecosystem.
- 3. Conservation of Water Resources** Water is a precious resource. ZLD systems recycle and purify wastewater, reducing the need for fresh water intake. By recovering near-pure water from wastewater, industries can reuse this water in their operations, helping to conserve valuable freshwater supplies and reduce reliance on external sources.
- 4. Reduces Operational Costs in Water Management** ZLD not only helps industries comply with environmental laws but also provides significant cost savings. With reduced dependence on external water sources, operational costs related to water procurement and treatment are minimized. Furthermore, the recycling of treated water reduces the need for expensive treatment chemicals and equipment.



# The Challenge

## – Tackling RO Reject Wastewater



### "The Unseen Problem: RO Reject Water and Its Environmental Impact"

Reverse Osmosis (RO) technology is widely regarded as one of the most efficient water treatment processes, effectively removing contaminants to provide purified water. However, it creates a significant challenge: RO reject wastewater. This byproduct, a highly concentrated mixture of salts, chemicals, and other contaminants, represents an often-overlooked environmental crisis.

If left untreated, RO reject water poses severe risks to both the environment and operational efficiency. The disposal of this wastewater can lead to pollution in nearby water bodies, disrupt ecosystems, and result in costly fines for non-compliance with environmental regulations. This creates a complex problem for industries relying on RO systems to treat large volumes of water.

The challenge, therefore, lies in efficiently managing RO reject water, ensuring it is properly treated, and recovering as much water as possible for reuse.

#### Visual Elements:

- **Infographic: "RO Reject Water – A Pollution Time Bomb"** : A visual depicting RO reject water as a ticking time bomb, highlighting its harmful components and environmental risks.
- **Diagram: "Untreated vs. Treated RO Reject Water"** : A side-by-side comparison showing untreated RO reject water next to treated water, emphasizing the need for effective treatment.

#### Key Challenges:

1. **Environmental Impact:** Untreated RO reject water can contaminate water bodies, disrupting ecosystems.
2. **High Operational Costs:** Treatment methods for RO reject water are energy-intensive and costly.
3. **Regulatory Pressure:** Stricter environmental norms demand effective wastewater treatment solutions.
4. **Waste Generation:** RO systems produce large volumes of reject water, requiring sustainable management.

# MEE Technology Used for ZLD and Its Disadvantages

## "Unveiling the MEE Problem: High Costs and Reliability Concerns"

### Mechanical Evaporation Evaporator (MEE)

MEE systems have been the traditional choice for achieving Zero Liquid Discharge (ZLD). The process involves evaporating wastewater, leaving behind concentrated solids. Despite their widespread use, MEE systems have significant operational challenges and drawbacks that can limit their effectiveness.

#### Disadvantages of MEE Systems:

- 1.High Energy Consumption
- 2.MEE systems require a substantial amount of energy for the evaporation process, making them expensive to operate over time.
- 3.Expensive Construction Materials
- 4.To withstand corrosive wastewater, MEE systems often rely on costly materials like duplex, super duplex, or titanium, leading to high capital expenditure (CAPEX).
- 5.High Operating Temperatures (>150°C)
- 6.These systems operate at extremely high temperatures, which necessitates robust and expensive construction materials to ensure system integrity.
- 7.Vacuum and Pressure Requirements
- 8.MEE systems require high-pressure steam (up to 8 bar) and vacuum, adding complexity to the system design and increasing operational challenges.
- 9.Scaling & Fouling
- 10.The accumulation of salts and minerals on heat transfer surfaces leads to scaling and fouling, disrupting the system's operation and requiring frequent cleaning.
- 11.Large Footprint
- 12.MEE systems often require a significant amount of space for installation, which may be problematic in industries with limited space.
- 13.Frequent Downtime
- 14.The need for regular cleaning and maintenance to prevent scaling and fouling leads to considerable downtime, reducing system efficiency and reliability.
- 15.Higher Operating & Maintenance Costs
- 16.The combination of high energy consumption, maintenance needs, and manpower results in significant operational costs.
- 17.Non-Scalability
- 18.MEE systems lack flexibility and scalability, making them unsuitable for industries with



# Introducing Ionic's Game-Changer – ZLD The Water Harvester

## "Redefining ZLD – The Future of Water Treatment is Here"

The Ionics Water Harvester is a groundbreaking, energy-efficient solution designed to revolutionize **Zero Liquid Discharge (ZLD)** management. By utilizing a nature-inspired **Humidification and Dehumidification (HDH)** process, the Water Harvester offers a **sustainable, cost-effective, and reliable** alternative to traditional MEE systems.

### Visual Elements:

- **Sleek System Image:** A modern and efficient design of the Water Harvester in action.
- **Process Animation:** Arrows demonstrating the flow of humidification and dehumidification steps.
- **Key Feature Icons:**
  - **Low Energy:** Minimal power consumption.
  - **Low Temperature:** No need for high temperatures.
  - **Corrosion-Resistant:** Durable, long-lasting materials.
  - **Compact Footprint:** Perfect for space-constrained environments.

### Why Choose the Water Harvester?

1. **Low Energy, High Efficiency:** The Water Harvester operates with minimal energy input, drastically reducing operating costs compared to traditional systems.
2. **Low-Temperature Operation:** No need for costly high-temperature equipment. The system functions effectively at low temperatures, reducing both energy consumption and capital expenditure (CAPEX).
3. **Corrosion-Resistant Design:** Constructed from non-metallic materials, the Water Harvester requires little maintenance, significantly lowering the long-term operating costs.
4. **Space-Saving Design:** With its compact footprint, the Water Harvester is ideal for industrial environments where space is at a premium.
5. **Scalable and Flexible:** This modular system is scalable and adaptable to a wide range of industries. Whether you are handling small or large wastewater volumes, the Water Harvester can be easily tailored to meet your specific needs.

# How it Works

## – Nature-Inspired Water Harvesting



### Mimicking Nature's Rain Cycle

The Ionics Water Harvester utilizes a humidification–dehumidification process, inspired by **nature's water cycle**. This process ensures efficient water treatment with minimal environmental impact. The system evaporates wastewater at **low temperatures**, concentrating salts and impurities, then condenses clean water through the **dehumidification process**.

### Key Advantages:

- **Efficient Water Recovery:** Recovers up to 99% of water, ensuring minimal water loss.
- **Energy Efficiency:** Consumes less energy than traditional MEE systems, making it more sustainable.
- **Reduced Operational Costs:** Can integrate with renewable energy sources like solar or wind, further cutting down energy costs.

# Technology Features & Benefits – of Ionic's Zero Liquid Discharge (ZLD)



## Technology Features & Benefits :

- **Mimics Nature's Water Cycle:** Emulates natural humidification and dehumidification processes for enhanced water treatment efficiency.
- **Renewable Energy Integration:** Easily integrates with solar or wind energy, reducing dependency on conventional power sources.
- **Non-Metallic, Corrosion-Resistant Construction:** Built using FRP with Vinyl Ester Resin, offering long-lasting durability and lower maintenance costs.
- **Low-Temperature Operation:** Operates at 60–90°C, minimizing energy consumption and enabling the use of cost-effective materials.
- **Ambient Pressure Operation:** Operates at ambient pressure, eliminating the need for complex vacuum pumps.
- **Multi-Stage Energy Recovery:** Optimizes energy use with multiple stages of energy recovery to further reduce costs.
- **Heat Pump Recycling:** Recovers heat from condensation to preheat the wastewater, improving energy efficiency.
- **Compact and Space-Saving:** Its small footprint reduces the space required compared to traditional MEE systems.
- **Automated Cleaning:** Features an automated "Clean in Place" system, minimizing maintenance and downtime.
- **Real-Time and Remote Monitoring:** Equipped with IIoT-enabled systems for remote operation and monitoring, improving system reliability.



# The Water Harvester Process – of Ionic's Zero Liquid Discharge (ZLD)

## Introduction to the Process

The Ionics Water Harvester operates as a low-temperature humidification-dehumidification evaporator designed specifically for treating RO reject water. This process separates dissolved salts and other impurities, recovering clean water and safely disposing of concentrated waste.



## Process Flow:

1. **Humidification Stage:** Wastewater undergoes evaporation in a low-temperature humidifier, using saturated steam at 6 bar to provide thermal energy for evaporation.
2. **Energy Recovery:** Heat exchangers and heat pump recycling preheat the wastewater, maximizing energy recovery.
3. **Dehumidification Stage:** Hot vapor is passed through a dehumidifier, where condensation recovers clean water.
4. **Concentration and Waste Disposal:** Concentrated salts and waste are periodically removed and processed in a drum evaporator, turning the residue into a slurry for safe disposal.
5. **Post Treatment Stage:** Water polishing using filter media and cartridges ensures high-quality water.

## System Components and Safety Features:

1. **Corrosion-Resistant Materials:** Built using FRP with Vinyl Ester Resin, ensuring a long lifespan and resistance to harsh wastewater conditions.
2. **Automatic Cleaning:** Features a "Clean in Place" system, reducing maintenance efforts by automatically cleaning key components.
3. **Safety Features:** Includes drum lifting and tilting mechanisms for safe handling of evaporator drums. Interlocks and sensor-based controls ensure safe operation at all times.

# Advantages & Benefits – of Ionic's Zero Liquid Discharge (ZLD)

## Advantages Over Traditional MEE Systems

1. **Lower Operating Costs:** Uses low-temperature evaporation and energy recovery to reduce energy consumption and material costs.
2. **Smaller Footprint:** The compact design requires less space, making it ideal for facilities with limited space and reducing installation costs.
3. **Environmental Sustainability:** Mimicking nature's water cycles, the system ensures zero liquid discharge, promoting sustainable water management.
4. **Energy Efficiency:** Integration with renewable energy sources and multi-stage energy recovery reduces operational costs while enhancing energy savings.



## Industries That Can Benefit

1. **Power Plants:** Ideal for treating cooling tower blowdown and other high-salinity wastewater.
2. **Textile Industry:** For effluent treatment in dyeing and processing plants.
3. **Pharmaceutical and Chemical Industries:** Perfect for managing high-concentration wastewater from chemical processes.
4. **Food & Beverage:** Efficient in treating effluent water while reducing overall water consumption.





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We're here to help you with all your water and wastewater treatment needs. Whether you're looking for customized solutions, technical support, or just want to explore how our services can benefit your business, feel free to reach out to us.

Our team of experts is ready to provide personalized assistance and ensure that you get the most effective and innovative solutions tailored to your requirements. You can contact us via phone, email, or through our website. We value every opportunity to collaborate and are committed to delivering excellence in every interaction.

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