20th AfWA International Congress and Exhibition 2020 Breaking new grounds to accelerate access to water and sanitation for all in Africa

Innovative Solutions for Wastewater Treatment and Recycle for Green Africa

24th – 27th February 2020, Kampala, Uganda

DR. S. KARTHIKEYAN
HEAD – PROJECTS & O&M
Arvind Limited, a part of the $1.7 billion Lalbhai Group was incorporated in 1931 and is in the businesses of Textiles – fabric & garment manufacturing, Branded apparel & Retail, Environment Solutions, Agriculture, Engineering and Real Estate.

Established in 2011, Arvind Envisol has witnessed strong pull from Indian and international market over last few years

AEL is a world class water management company providing end to end solutions for water treatment, industrial waste water treatment, sewage treatment, desalination and Zero Liquid Discharge (ZLD) solutions at minimal costs.

150+ Million Litres water and waste water processed per day

120+ Projects executed till date

38 Registered Patents across the globe

END TO END Offerings in the entire water chain

STRONG Pre Qualification References
What We Do?

In order to cater to different need segments and organized into 3 verticals

- **Infra Practice**
  - Projects on EPC as well as on BOOT basis
  - Sectors include:
    - Municipal
    - Industrial
    - Desalination
    - Drinking water
    - Hi-purity water

- **Design, Service & Support (DSS) Practice**
  - Offerings to clients and partner OEMs through in-house brand
  - Products and services include:
    - Components
    - Consumables & Spares
    - O&M / AMC
    - Retrofitting

- **Knowledge Practice**
  - Niche services offered to customers / Analytics
  - Services include:
    - Consulting
    - Training
    - Collaboration & Research

Textiles  Pharma  F&B  Chemicals  Oil & Gas  Automobiles  ..& Other Industries
offering solutions across water, waste water, solid waste and emission problems employing clean energy

Convergence Approach
What Is ZLD and How It Works?

Zero Liquid Discharge
Envisol’s heart beats to purify and recycle waste water through patented technologies

ZLD is a water treatment process in which all waste water is purified and recycled leaving zero discharge at the end of treatment cycle.
How Do We Do?

Through Turnkey EPC Projects – we enable sustainable operations

**Sustainable Outcome**

- **CUSTOMERS**
  Clean, efficient operations and high return on investment

- **SUPPLIERS**
  We build partnerships with our supplies on long term basis

- **EMPLOYEES**
  Meaningful and rewarding jobs

- **SOCIETY**
  Improved resource efficiency, clean environment, prosperity

- **SHAREHOLDERS**
  Investing in a responsible company

- **ECOLOGICAL FOOTPRINT**
  Technologies with low impact

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**How Do We Do?**

- **Solution Definition**
- **Design, Engineering, Sourcing & Delivery**
- **Feasibility Study & Analysis**
- **Installation & Commissioning**
- **Upgrades & Expansions**
- **Operation & Maintenance**
### Typical Wastewater Characteristics for Textile Industry Waste Water

#### Common Textile Effluent Characteristics

<table>
<thead>
<tr>
<th>Common Textile Process</th>
<th>TSS</th>
<th>COD</th>
<th>pH</th>
<th>Colour</th>
<th>TDS</th>
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<tbody>
<tr>
<td>Dyeing</td>
<td>200-300</td>
<td>1000-1500</td>
<td>10-11</td>
<td>3000-5000</td>
<td>3000-4000</td>
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<tr>
<td>Printing</td>
<td>500-800</td>
<td>4</td>
<td>8.5-10</td>
<td>10000-15000</td>
<td>1200-15000</td>
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<tr>
<td>Beaching</td>
<td>2</td>
<td>5</td>
<td>0</td>
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<td>0</td>
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<td>Mercerizing</td>
<td>1</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Sizing / De-sizing</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Washing</td>
<td>2</td>
<td>3</td>
<td>2</td>
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<tr>
<td>Paper</td>
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<td><strong>20</strong></td>
<td><strong>12</strong></td>
<td><strong>5</strong></td>
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</table>

#### Waste-water Discharge Norms

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Foundational</th>
<th>Progressive</th>
<th>Aspirational</th>
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<tbody>
<tr>
<td>Temperature [°C]</td>
<td></td>
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</tr>
<tr>
<td>TSS</td>
<td>50</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>COD</td>
<td>150</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>Total-N</td>
<td>20</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>pH</td>
<td>6-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colour [m³]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonium-N</td>
<td>10</td>
<td>1</td>
<td>0.5</td>
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<tr>
<td>Total-P</td>
<td>3</td>
<td>0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>AOX</td>
<td>5</td>
<td>1</td>
<td>0.1</td>
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<tr>
<td>Oil and Grease</td>
<td>10</td>
<td>2</td>
<td>0.5</td>
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<tr>
<td>Phenol</td>
<td>0.5</td>
<td>0.01</td>
<td>0.001</td>
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<tr>
<td>Coliform [bacteria/100 ml]</td>
<td>400</td>
<td>100</td>
<td>25</td>
</tr>
</tbody>
</table>
Typical Process Schematic Diagram for Textile Industry Waste Water ZLD

INLET

- EQUALIZATION TANK
- COAGULATION & FLOCCULATION
- PRIMARY CLARIFICATION
- BIOLOGICAL SYSTEM
- ULTRA FILTRATION (UF) SYSTEM
- SLUDGE DEWATERING + DRYING SYSTEM

SALTS

- MULTIPLE EFFECT EVAPORATOR (MEE)
- POLYMERIC FILM BASED EVAPORATION TECHNOLOGY (PFET)
- RO REJECT COLLECTION TANK
- REVERSE OSMOSIS (RO) SYSTEM
- TREATED WATER COLLECTION TANK
11 MLD Zero Liquid Discharge Plant at Hawassa Industrial Park, Ethiopia
Case Study of Arvind Limited, Santej, India
Largest single premise 17,000 M³/day Textile Effluent ZLD plant in Asia
Case Study of Hawassa Textile Industrial Park, Ethiopia
Envisol built state-of-the-art ETP + STP of 11,000 m³/day capacity

<table>
<thead>
<tr>
<th>Key Facts:</th>
<th>Effluent coming from Textile Sizing, De-sizing, Dyeing, Finishing, Washing &amp; Garmenting units dealing in Cotton as well as MMFs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effluent Treatment Capacity</td>
<td>8 Million Litres Per day (8000 cu.mt per day).</td>
</tr>
<tr>
<td>Sewage Treatment Capacity</td>
<td>3 Million Litres Per day (3000 cu.mt per day).</td>
</tr>
<tr>
<td>Treatment Plant Area Spread</td>
<td>32,000 Square meters.</td>
</tr>
<tr>
<td>Green Belt Area Spread</td>
<td>10,000 Square meters.</td>
</tr>
<tr>
<td>Tallest Structure</td>
<td>25 meters.</td>
</tr>
<tr>
<td>Treatment System</td>
<td>Zero Liquid Discharge.</td>
</tr>
<tr>
<td>Water Storage Capacity</td>
<td>5 Million Litres (5000 cu.mt.)</td>
</tr>
</tbody>
</table>
## Case Study of Sewage to Textile Process Water, Arvind, India
First of a kind Zero Ground Water use 8,000 m3/day treated Sewage to Process Water Plant

<table>
<thead>
<tr>
<th>Key Facts</th>
<th></th>
</tr>
</thead>
</table>
| **Bagged Order:**          | 2019
| **Completed:**             | 2019
| **Sewage Treatment Capacity:** | 8 Million Litres Per day (8000 cu.mt per day). |
| **Tertiary Treatment Technology:** | Membrane Bio-Reactor + Ozonation |
| **Sludge Treatment Technology:** | Heat-pump based Low Temperature Dryer |
| **Treatment Plant Area Spread:** | 3000 Square meters |
| **Water Source:**          | Ahmedabad City Municipal Sewage Line |
| **Water Storage Capacity:** | 4 Million Litres (4000 cu.mt.) |
Case Study of Denim Washing Waste-Water Recycling Plant, Bavla, India
500 (+500 planned) m3/day Closed Loop Water circuit at Denim Washing Unit

Key Facts:

- **Effluent Treatment Capacity:** 500 Kilo Litres Per day (500 cu.mt per day).
- **Wash / Bleach Types:** Enzyme Wash, Stone Wash, Chlorine Bleach
- **Treatment Technology:** Speciality Membranes eliminating Secondary
- **Sludge Treatment:** Zero Biological Sludge Generation
- **System Design Type:** Modularized, Pre-fabricated System
- **Treatment Plant Area Spread:** 500 Square meters
Case Study of Tannery Effluent ZLD Plant, Vanitec CETP, India
1200 m³/day Tannery effluent ZLD using Patented PFET; Managing complete plant O&M

Key Facts:
- **Industry Type:** Tannery
- **Key Processes catered:** Hair Removal, Leather Softening, Dyeing
- **Effluent Treatment Capacity:** 1.2 Million Litres Per day (1200 m³ per day).
- **Contract Scope:** Supply of PFET, O&M Entire Plant
- **Key Technology Elements:** Screens, Anoxic, Tubular MBR & PFET

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Feed</th>
<th>Permeate</th>
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</thead>
<tbody>
<tr>
<td>TSS (mg/L)</td>
<td>3648</td>
<td>0</td>
</tr>
<tr>
<td>COD (mg/L)</td>
<td>4576</td>
<td>34</td>
</tr>
<tr>
<td>BOD (mg/L)</td>
<td>1515</td>
<td>1</td>
</tr>
<tr>
<td>pH</td>
<td>6.2</td>
<td>6.9</td>
</tr>
<tr>
<td>TDS (mg/L)</td>
<td>19820</td>
<td>560</td>
</tr>
</tbody>
</table>
Zero Liquid Discharge

Envisol is a market leader in Zero Liquid Discharge - recycling waste water through patented technologies.

Patented Polymeric Film MVRE for 12 MLD ETP, Veerapandi, India
Patented ZLD Technology – Polymeric MVRE

Patented heat transfer polymer element enables efficient heat transfer at lower temperatures. Improves efficiency and uses MVRE for reduction of costs and maintenance.
Significant advantages in operating costs can be achieved through Polymeric Film Evaporation Technology

### Operating cost comparison – Rs/m³

<table>
<thead>
<tr>
<th></th>
<th>MEE - 1 Stage</th>
<th>MEE - 4 stage</th>
<th>Conventional MVR</th>
<th>Polymeric MVR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption¹ (KwH/m³)</td>
<td>35</td>
<td>22</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Steam consumption¹ (Kg/m³)</td>
<td>1100</td>
<td>320</td>
<td>25</td>
<td>15</td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymeric Heat Exchanger</td>
<td>Conventional heat exchanger</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimal Steam Consumption- only for initial heating</td>
<td>Higher steam consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower temperature differences</td>
<td>Higher temperature difference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher surface area along with it being smooth and flexible</td>
<td>Lower surface area along with it being rough and rigid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOC - Polymer</td>
<td>MOC – Titanium or equivalent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning by water itself</td>
<td>Cleaning by Chemicals</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Approx. 40% lower operating costs
- Lower temperature differences
- Minimal Steam Consumption- only for initial heating
- Higher surface area along with it being smooth and flexible

![Diagram showing cost comparison and advantages](image-url)
Crystallizer Unit & Salt Recovery Application
How Do We Do?

Through Well Established Technology

**Primary treatment**
To remove physical impurities like suspended solids, oil and colour

- Clarifiers and Clari-flocculator
- Tube settlers/parallel plate separators
- High rate solid contact clarifiers
- Dissolved air floatation (DAF)
- Electro Coagulation
- Pipe flocculator

**Secondary treatment (Biological Processes)**
Degrading organic material in the waste water like BOD and COD

- Activated Sludge Process (ASP)
- Extended Aeration system (EAS)
- Upflow Anaerobic sludge blanket reactor (UASB)
- Sequential Batch Reactor (SBR)
- Moving Bed Bio Reactor (MBBR)
- Membrane Bio reactor (MBR)
How Do We Do?

Through Innovative Technologies

Evaporation Technologies

- Mechanical Vapor Recompression (MVR) OR Multi Effect Distillation (MED)
- Multi Effect Evaporators (MEE) and Crystallizers
- Multi Stage Flash (MSF) Evaporators
- Agitated Thin Film Dryer (ATFD)

Sludge Management Technologies

- Sludge Digester
- Incinerator
- Screw Press
- Centrifuge
- Filter Press
- Belt Press
How Water Looks After & Before Treatment?

Zero Liquid Discharge Treatment Plant Water Samples
We Offer Efficient Operations and Maintenance Services after Installation

How We Can Sync?

1. Zero downtime
2. Reduced Opex
3. Long life of capital equipment
4. Keep updated with latest technology
5. Compliance to safety norms
6. No budgetary risk
What Makes Envisol a Preferred Partner?

1. One stop place for all type of water and waste treatment related customer requirements – Projects, Spares, Services

2. Single window for best globally available technologies across entire water treatment spectrum (either through own patents or licensed partners)

3. An extensive technology portfolio along with in house R&D Center

4. Proven process know how and experience

5. Experience as a reclamation plant operator

6. Multinational experience, which ensures an understanding of different local needs

7. Strong team of over 400 people; Industry veterans, respected by customers, vendors and competitors
How Do You Benefit?  You Will Get Best Class Solutions From KaiGO

**RO, UF and NF Membranes**
KaiGO is an authorized distributor for Hydranautics membranes. It is highly energy saving and low fouling on account of its composite polyamide membrane.

**MBR (Membrane Bio Reactor)**
KaiMBR is a combination of membrane processes like UF with the ASP process. It has a small footprint, easy retrofit and enables upgrade.

**Pressure tubes**
KaiTUBE FRP pressure vessels are membrane housings for industrial and commercial water treatment applications such as desalination and reverse osmosis (RO).

**FRP tanks**
KaiTANKs, used to hold filter media, are manufactured with high quality FRP resin, suitable for drinking water, light in weight and 100% hydro tested with certificate.

**Motorized Dosing pump**
KaiDOSE motorized dosing pumps are suitable for larger volume dosing application. Mechanical, hydraulic & plunger options available.

**High pressure pump**
KaiPUMP can be used for both positive and negative displacement application. USPs include pump casing thickness of 1.5 mm, top and bottom casings of SS304, cartridge & split type mechanical seal etc.
How Do You Benefit? 

You Will Get Best Class Solutions From KaiGO

Electronic dosing pump
KaiDOSE is a positive displacement pump. It pumps a very precise flow rate of a chemical into a tank. USPs – Air relief valve, solid PTFE diaphragm, Double NRV check valves, min SPM of 120

Filter press
KaiPRESS is specially designed to de-water sludge. It has various plate MOCs (PP/CI/SS), range of sizes, option for manual/hydraulic operation.

Valves
KaiVALVES control the flow and pressure within a system or process. Available from 1” to 40” in size and 150# to 2500# Class. Types available Gate/ Glove/ Check/ Butterfly/ Ball/ NRV/ Diaphragm

Belt press and thickeners
KaiBELT is rapidly turning out to be a good alternative to the manual Filter press. Fully automatic with option for thickener, it gives upto a 30% solid consistency at outlet.

MBBR
KaiMBBR has 3 variants – PVA, Biochip and PU media, with surface areas ranging from 3000 m2/m3 to 47000 m2/m3. Reduces tank footprint, life > 5 years, highly resistant to wear and tear.

ETP and RO Chemicals
KaiCHEM offers several chemicals for water treatment
- Color removing chemicals
- Coagulants
- Polyelectrolytes
- RO antiscalants, cleaning and biocides
Finally What Precious Products You Will Get?

- Treated Water
- Recovered Salt
- Sludge
What Additional Benefit You Can Expect?

**Water audit and consulting**
- Project management consulting and assessment
- Review of existing design parameters and quality of source
- Recommendation to enhance the performance and longevity of the existing plant.
- Regular scorecard to accredit compliance to best practices

**Water testing**
- Envi – Lab facility to test the customer’s source water
- Effluent and report the required parameters.
- Spectrometer

**Training, R&D and skill development**
- Training packages and courses
- Government approved training centers
- Studies cover both theoretical and practical knowledge applications
- R&D facilities to help you design new offerings
Who are already benefitted?

Some of our valued Customers
Infra Practice: Executed EPC Projects for Wastewater Treatment, Recycle-Reuse, Zero Liquid Discharge, is varied sectors Globally

<table>
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<tr>
<th>Industry Sector</th>
<th>No of Projects</th>
<th>ZLD</th>
<th>WWR</th>
<th>WWTP</th>
<th>STP</th>
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<tr>
<td>Textile / Tanneries / Dyes / Pigments</td>
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<td>49</td>
<td>25</td>
<td>16</td>
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<tr>
<td>Auto / Engg / Metal / Steel / Mining</td>
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<td>Pharma / Chemicals</td>
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<td>F&amp;B / Dairy / Sugar</td>
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<td>Petroleum / Power / Infra</td>
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<td>Paper</td>
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<td><strong>Grand Total</strong></td>
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<td><strong>99</strong></td>
<td><strong>42</strong></td>
<td><strong>27</strong></td>
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International Projects

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<td>Malta, Europe</td>
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<td>South Africa</td>
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<tr>
<td>Singapore</td>
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<td>Taiwan</td>
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</tr>
<tr>
<td><strong>Grand Total</strong></td>
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</table>

ZLD = Zero Liquid Discharge, ERS = Effluent Recycling System, ETP = Effluent Treatment Plant, STP = Sewage Treatment Plant
Envisol has a global footprint with a modern supply chain and offices spread across 6 continents.

India footprint

Global footprint

- Offices / Partner locations
- Warehouse
- Manufacturing
Thank you

For Kind Attention!!!

Email id: support.envisol@arvind.in

Contact: 18008439988 (toll free), +917930136056, +251-91 250 4308

HO address: Arvind Envisol Ltd., Arvind Mill Premises, Naroda road, Ahmedabad – 380025, India