Nanoflotation · HiFF · Replaceable Skin Layer Membranes (RSL Membranes™)

2017 Finalist for the Most Disruptive Sustainable Technology in the World

Potable Water Treatment with RSL Membranes™

A new and disruptive water treatment technology has been developed to replace existing filtration and oil separation technology resulting in a 10 fold improvement in capacity, 90% reduction in energy and 25 to 40% reductions in capital and operating costs. The technology, known as RSL Membranes™, was a finalist in the 2017 California based Katerva awards as the most disruptive sustainable technology in the world. Also after third party peer review, the Chinese Ministry of Environmental Protection selected RSL Membranes™ as one of the top 100 environmental technologies in the world.

Conventional Low Pressure Membranes (Micro or Ultrafiltration membranes)
conventional attached skin layer with typically 0.01 to 0.1 micron pore size- skin layer needds to be cleaned and is not replaceable

RSL is the acronym for "Replaceable Skin Layer" membranes. Conventional membranes have two layers; a porous substrate layer and an attached skin layer that has micropores (0.01 to 0.1 microns). It is the skin layer that acts as a barrier to separate solids from the water. However, one of the problems with skin layers is that they become fouled and cleaning the skin layer is difficult. RSL Membranes™ use the same porous layer as conventional membrane but instead of an attached skin layer, RSL Membranes™ use a powder to create the skin layer. When the skin layer becomes fouled it is replaced. The removal and replacement of the skin layer takes less than 4 minutes and occurs while the filtration process is operating.

The technology is well proven. Waters containing very high suspended/colloidal solid content and emulsified oil are easily treated.

Scrubber Wastewater from Refineries.
Left photo: RSL (white) powder on the surface of Stainless steel membrane tubeready for filtration,
Center Photo: After 6 hrs of filtration, TSS concentrated on upstream side of Membrand to 9500 mg/. Transmembrane pressure 35 kpa
Right photo: shows raw water TSS > 500 mg/l ,9 hour filtration.TSS in permeate <2 mg/l, NTU<0.5 and TSS in Membrane Housing was 13000 mg/l

Oil Removal from Refinery Coker Process

After RSL Membrane Water Sample

Right to Left: Raw Water /Oil : After Flotation- free oil removed -emulsified oil 2000 mg/l : After one pass of RSL Membranes™ Oil 29 mg/l, NTU 0.55. Flux rate is 375 lmh

The first one year evaluation of the technology was undertaken through a third party independent review process. Twelve technologies were originally selected and were then narrowed to two technologies for field testing. The two technologies were RSL Membranes™ and a ceramic membrane marketed by Veolia, the world's largest water treatment utility operator. It was through this testing that the Replaceable Skin Layer (RSL) Membranes™ were rated has having a 10 fold improvement in capacity compared to the conventional ceramic membranes. For example, where conventional membranes require 1000 m^2 of membrane area to treat a specific water, the area required for RSL Membranes™ is 100 m^2.

This simple and easy to operate technology replaces

- Clarifiers
- Flotation processes
- Sand filters
- Disposable bag or Cartridge filters
- Oil water separators, and
- Conventional membranes

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The benefits are not only significant but provide a level of simplicity beyond any water technology available today

- One main process unit (RSL Membranes™) for operations staff to operate and maintain
- Three easy operational steps; (1.) filtration; (2.)backwash; (3)placement of the replaceable skin layer
- Easy automation
- Small area requirement
- Easy management of concentrated solids/sludge removed from water
- Easy maintenance
- Reduced chemical addition
- Easy application of smart data systems and data analytics.
- The lowest capex and opex costs of any water treatment technology
- 90% reduction in energy consumption

RSL Membrane™ Housing for 10 m3/hr in a 6 m trailer

A typical RSL Membranes™ housing is shown above. This membrane housing will treat 240,000 litres of water a day. For a small community this level of water treatment would serve a population of 1000 people. For most small communities, the entire treatment system can be housed in a 6.1 m trailer or a 12.2 m trailer.

Inside the housing are a bundle of tubes as shown below.

Stainless Steel tube bundle for 25 m3/hr which is placed in 1 m diameter Housing

In most cases, the only additional process equipment necessary would be a small air compressor to operate the pumps and valves and a chlorine disinfection system to ensure chlorine residual in the treated water. In some cases, if organics are high in the raw water, an activated carbon column would be required after the RSL Membranes™ and before disinfection.

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