

## Oil Removal

**RSL Membranes™** are used successfully to remove free oil and emulsified oil. **RSL Membranes™** have been applied to both refinery waste waters and produced waters that are generated from oil and gas upstream production facilities. The technology provides a unique opportunity to simultaneously remove oil and colloidal solids from one process unit. Success has been achieved to separate the oil using the **RSL Membranes™**. Once the oil is separated, it can be continuously removed from the housing. The solids are removed during the back wash. Research continues improving the repulsion of hydrocarbon-based oils from the RSL powder. However to date there has not been the same success in the separation of vegetable oils.

### Produced Water

In oil and gas operations, produced water is a significant volume. For every m<sup>3</sup> of oil produced there are 4 to 7 m<sup>3</sup> of water produced. The produced water typically contains TSS (20 to 150 ppm), high TDS specifically sodium and chlorides (2000 to 250,000 ppm), and oil (30 to 200 ppm). The RSL Membranes™ treat produced water in this high TDS environment such that the treated water is consistently less than 5 ppm of oil (typically 1 ppm), less than 1 ppm of TSS and less than 1-micron particle size. **RSL Membranes™** have been used in China, the US and Canada to treat produced water. Isle Utilities, a global water technology assessor, has identified **RSL Membranes™** as the lead technology to be assessed for offshore rigs. Petro China has rated **RSL Membranes™** as the best produced water treatment technology in the world.



Produced Water treatment-Raw water 132 NTU Permeate <0.5 NTU- Permian Basin New Mexico



Produced Water Treatment Raw water 161 NTU Permeate <0.3 NTU- Permian Basin Texas



Left- Operator taking sample of raw water- Two Membrane Housings 12.5 m<sup>3</sup>/hr each  
Right- Operator taking sample of permeate from Membrane housing 1



Left -Raw produced water: Center-Permeate- housing 1 and 2; Quality-1 ppm oil, <1ppm TSS,<1 micron:  
Right – Oil separated in Housing and automatically drained from housing

### **Refinery process Water**

Many of the refinery process waters have free and emulsified oil in the process water which needs to be removed for reuse. RSL Membranes™ provide an excellent level of oil and solid separation in Refinery process waters. A 25 m<sup>3</sup>/hr **RSL Membrane™** has been installed in a refinery and has shown the capability of separating emulsified oils from process water



Left: Single housing 20 m<sup>3</sup>/hr treating Coker Process water in a refinery and installation  
Right: Taking raw water sample and permeate sample



Right: Raw water with high amount of free oil  
Center: After Nitrogen Induced Gas Flotation to remove free oil. 2000 ppm emulsified oil  
RSL Membrane permeate: <25 ppm oil.

## Research and Development

1. Improve separation of vegetable-based oils through the use of modified powders or temperature