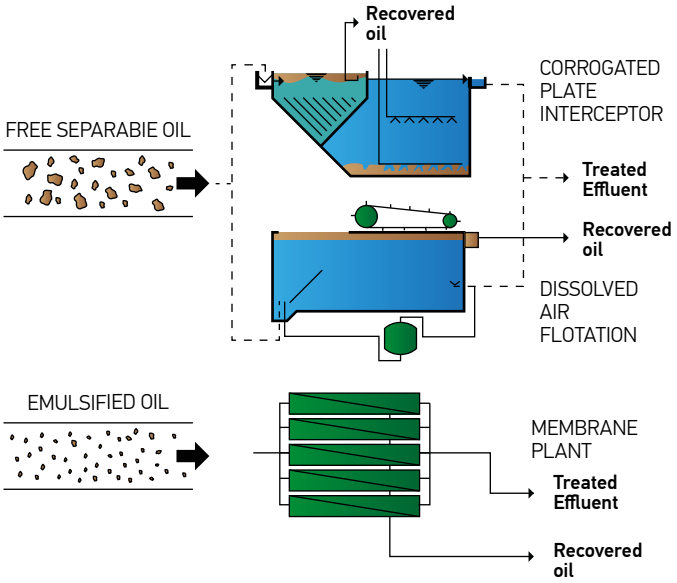
# OIL INDUSTRY APPLICATION

## PRODUCED WATER TREATMENT AND OIL RECOVERY

Esmil Process Systems together with our partners have conducted much research and constructed many plants gaining vast experience in the Oil industry. From bench scale studies right the way through to full scale plant operations we strive to offer BAT (Best Available Technology) using state of the art membrane separation and dewatering processes.

## RANGE OF TECHNOLOGIES

Our wastewater treatment technology for Oil industry is based on combination of conventional physicochemical pre-treatment methods such as **Corrugated Plate Interceptors (CPI)** or **Dissolved Air Flotation (DAF)** followed **by Membrane Technologies** and polishing methods such as **Ion Exchange** and **Activated Carbon** to meet the most challenging discharge requirements.




Among technological equipment used in Esmil technology are:

Corrugated Plate Interceptors (CPI)

- Efficient gravity separators
- Removal of gross solids and free oil
- >75% free oil removal

Dissolved Air Flotation (DAF)

- Highly efficient air assisted separators
- Treatment of effluent from CPI's
- >95% free oil removal

Membrane systems

- Optimum emulsified oil recovery
- < 1ppm oil in permeate/treated water
- Low capital and operating costs

## ESMIL TECHNOLOGY APPLICATION IN OIL INDUSTRY

Esmil offer a range of solids removal and oily-water separation process technologies applicable across the entire range of effluents from upstream, midstream and downstream oil operations including:

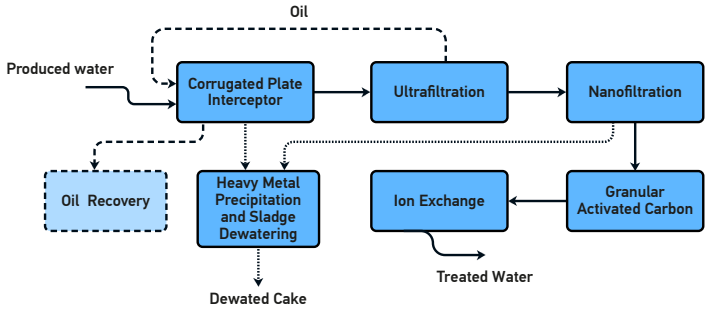
- **Produced Water** – separated during the separation of crude oil
- **Desalter Water** – generated during crude oil washing
- **Ballast Water** – for incoming sea tankers
- **Terminal and Refinery Process Drainage** – oil spills and general oily waste waters

Esmil offer systems for both onshore and offshore installations. Services include project management, design and engineering, specification and procurement, delivery and installation.

## PROCESS EXAMPLE FOR PRODUCED WATER TREATMENT

The Esmil philosophy for Produced Water Treatment utilises conventional separation processes for the removal of bulk contaminants, followed by state of the art membrane separation and absorption processes to achieve very low levels of contaminants in the treated effluent. This philosophy enables the plant to function reliably, even with wide range of variations in feed quality.

Conventional pre-treatment, such as **Corrugated Plate Separation, Hydrocyclones, Air Flotation** or **Sand Filtration** is used to remove the bulk of the oil and suspended solids. The 'clarified' water is physically polished by membrane **Ultrafiltration,** which reduces oil concentration to less than 0.3 mg/l, and suspended solids to below the limits of detection.




The oil and suspended solid free water is treated using membrane **Nanofiltration,** which removes the bulk of heavy metals and organic compounds. Trace organics and heavy metals in the Nanofiltration permeate are removed by **Activated Carbon** absorbers and selective **Ion-Exchange** resin. The pre-treatment by Nanofiltration significantly increases the bed life of these two media..

## OIL RECOVERY

Ultrafiltration reject is recycled to the front end of the process and the concentrated oil from CPI unit is reclaimed on site. The various sludge and aqueous waste streams are combined before undergoing precipitation, flocculation and filtration, to produce a 'cake' for landfill, and a filtrate that can be recycled through the process.

The degree of treatment is designed to meet client specified limits such that the treated water is suitable for re-use on site or discharge to water course.

## TYPICAL TREATMENT EFFICIENCY

| Parameter | Feed | Treated |
|---|---|---|
| Suspended Solids | 100 mg/l | < 0.1 mg/l |
| Oils, Fats and Greases | 15 mg/l | < 0.3 mg/l |
| Mercury | 1 mg/l | 0.0005 mg/l |
| Lead | 0.5 mg/l | 0.005 mg/l |
| PAH | 1 mg/l | 0.0002 mg/l |
| Iron | 185 mg/l | 1 mg/l |
| Sulphate | 4093 mg/l | < 50 mg/l |
| Chromium | 0.5 mg/l | 0.1 mg/l |
| Zinc | 25 mg/l | 0.1 mg/l |

## ESMIL DESIGN PHILOSOPHY

We strive to use the most appropriate solution to suit your treatment and/or recovery requirements. We are not limited to a single technology as we have a vast range of experience in the majority of treatment technologies. This includes membrane bio reactors, aerobic treatment, media filtration, ion exchange and other membrane technologies across a range of effluents and industries.

As no two processes are equal it is essential to follow a number of steps to ensure that your tailored metal application treatment/recovery process performs as well and economically as possible to achieve your treatment goals.

- Lab scale dewatering and membrane trial and selection to ensure process feasibility
- Long term site pilot trial to allow for feed variation and data gathering
- Extensive plant design and OPEX calculations
- Build, Installation and Commissioning
- Comprehensive service support including maintenance and system upgrades.

## REFFERENCES

**ESMIL have installed over 50 installations over the past 25 years, including:**

- CPI Unit, 220 $m^3/h$ Oil Refinery, Kuwait National Petroleum Company, Kuwait
- CPI Unit, 420 $m^3/h$ Oil Refinery, M W Kellogg, Shell Oil, UK
- DAF Unit, 140 $m^3/h$ Oil Refinery, Hydrotechnik GmbH, Al Madain, Iraq
- CPI and Membrane, 240 $m^3/h$ Produced Water, Petrofac Ltd, Siberia
- DAF Units, Belt Filter Presses, 120 $m^3/h$, Oil Refinery, Vankor Field, RF

## CONTACTS

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