

Spent Caustic Treatment Package**Product Coding**
PXXXXXXXXX**Introduction**

In recent decades, rapid industrial growth, particularly in oil, gas, and petrochemical sectors, has led to a significant increase in industrial wastewater. One of the major pollutants in this wastewater is used caustic soda (sodium hydroxide). It is widely employed in refineries and petrochemical plants to remove acidic and sulfide compounds from oil and gas streams. Used caustic is typically dark in color and contains hazardous and toxic substances such as sulfides and mercaptans. Discharging it without proper treatment can pollute the environment, contaminate water and soil, and pose serious risks to human health, as these compounds are easily absorbed and have harmful effects on ecosystems and communities. Therefore, removing and properly treating used caustic before it enters the environment is essential. Treatment processes not only neutralize its alkalinity but also allow for the recovery and reuse of materials, helping to reduce both environmental impact and industrial costs.

**Spent Caustic Treatment**

The spent caustic treatment package is an advanced solution designed by Euroslot Pars to treat and neutralize spent caustic streams, particularly those containing high concentrations of hydrocarbons (red oil) and other organic contaminants. This package reduces COD to below 3000 ppm and adjusts the PH for safe downstream processing or disposal.

Applications

- Petrochemical plants
- Refineries
- Chemical processing industries



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Spent Caustic Treatment Package**Product Coding**
PXXXXXXXXX**Process Overview**

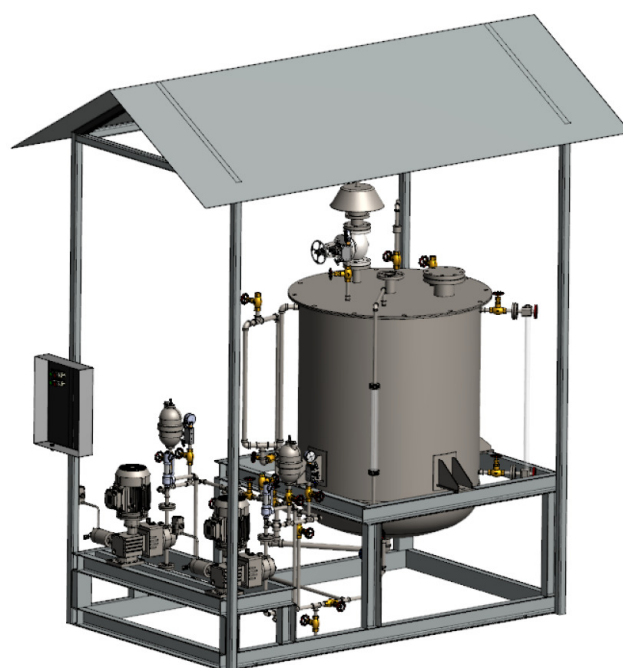
- **Demulsifier injection:** Breaks emulsions and facilitates oil separation.
- **Spent caustic storage tank:** Collects treated stream; equipped with a level transmitter and optional oil skimmer.
- **Parallel plate interceptor:** Separates free oil droplets ($> 60 \mu\text{m}$) and heavy solids from the spent caustic stream using oleophilic plates and a rotating oil drum skimmer.
- **Skimmer:** Separate and collect red oil from the storage tank by skimming its surface and transferring it via a flexible hose. Prevents downstream contamination, reduces effluent pollution, improves product quality, and ensures safe, continuous operation.
- **Upflow oil coalescer with a resin bed:** Employs oleophilic resin to coalesce and separate micro oil droplets into larger drops that can be decanted.
- **Cartridge filters (optional):** Final polishing filters with polypropylene cartridges to reduce residual oil content to 10 ppm.
- **Static mixer with ceramic raschig rings:** Provides thorough mixing of acid and caustic to neutralize pH to ~ 7 using ceramic Raschig rings.
- **Spent caustic degassing vessel with sieve trays:** Vertical vessel with sieve trays for gas-liquid separation; removes acid gases before final discharge. Removing gas from the mixer outlet stream and burning it through the flare and $\text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$ package outlet.
- **Spent caustic storage tanks:** It receives the treated stream from PPI.

Equipments

The equipments are listed and expressed below:

- **Demulsifier Injection**

The demulsifier is injected at the very beginning of the process to make it easier for the parallel plate interceptor (PPI) to separate red oil from the spent caustic by reducing the stability of oil and wastewater emulsions.



- **Parallel Plate Interceptor (PPI)**

It's a separator that is simple, efficient, compact equipment designed to remove and recover oil from waste water which can contain sediments. The separator is equipped with a pack of parallel plates, an oleophilic drum skimmer, and an absorbing filter.



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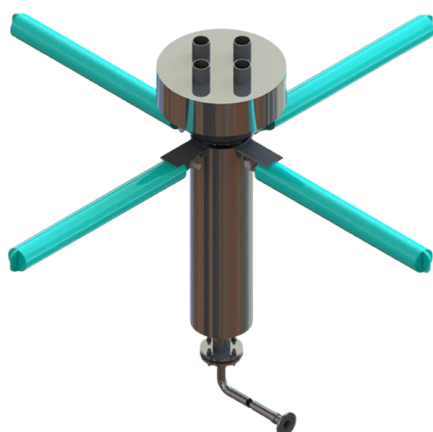


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Hydrocarbons are recovered continuously and selectively with a rotating oil drum skimmer.

The RODS consists of a cylinder covered with an oleophilic and hydrophobic film. The device, continually rotating on the surface of the water, picks up the hydrocarbons and any other oleophilic compounds which are then recovered and carried to a fixed trough by means of a scraper. The oil will be discharged by gravity to the oil storage tank.

**Upflow Oil Coalescer Units with a Resin Bed**

The oil condensate travels along the bottom of the vessel and goes up across the bed of oleophilic resin. The filter is characterized by a correct attrition resistance. This material picks up the micro drops from the water and forms around the grains a coat which periodically releases great drops of oil to the top of the vessel. The drops go up in the vessel because they present a low density and a large size. The treatment doesn't change the mineralization characteristics of the fluid. As oily water flows through the bed of resin, the tiny oil droplets coagulate into large droplets of oil. The oil film detached is rebuilt on the surface of the balls; the process is then self-regenerated. A timer is used to extract the oil periodically and automatically. The frequency and the duration of evacuation of oils will be designed according to the operating parameters on site. The pressure drop in the coalescing bed is detected by an inflow-outflow pressure differential indicator.

Static Mixers with Ceramic Raschig Rings

The unit is designed in accordance with ASME Section VIII Division 1 and is supplied complete with lifting lugs, supports, and a nameplate. A static mixer is incorporated to neutralize the spent caustic stream by thoroughly mixing it with sulfuric acid (H_2SO_4), reducing the effluent pH to approximately 7 before it enters the degassing vessel. The mixer is filled with ceramic Raschig rings to maximize contact surface and mixing efficiency, providing reliable performance without the need for any moving parts.



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This is a vertical vessel designed to separate gases (such as H_2S and fuel gas) from the liquid spent caustic stream after neutralization in the static mixer.

Ensures the liquid leaving the system is free from hazardous gases before discharge or further treatment.

Plays a key role in reducing COD and making the effluent safer for downstream handling. After mixing with acid in the static mixer, the effluent enters this vessel.

The sieve trays increase gas-liquid contact and enhance degassing. Gases (fuel gas, acid gases) are released from the top and routed to the Acid Flare. Treated liquid exits from the bottom for final discharge.

**▪ Spent Caustic Storage Tank**

Acts as a buffer tank before the fluid is sent to the next treatment stages (acid injection, coalescer, filters, mixer, degassing). Equipped with a level transmitter sensitive to red oil ensures that any separated oil can be skimmed and recycled back to the PPI. Provides temporary storage and allows stabilization before further treatment.

▪ Cartridge Filters-Optional Polishing Stage

It works as the final safety net to ensure near-complete oil removal, protecting downstream neutralization and degassing units while improving overall compliance with environmental discharge standards. The system is typically configured with two cartridge filters, with the option for parallel installation. The filter media is made of oleophilic and hydrophobic polypropylene fibers, each cartridge capable of absorbing approximately 8–10 kg of hydrocarbons or chemicals. The unit achieves about 97% removal efficiency for hydrocarbons, including emulsions, and the cartridges are generally replaced every six months depending on operating conditions. It can absorb a wide range of pollutants such as hydrocarbons, solvents, polishes, paints, and more than 4,600 chemical products, with the absorbed liquids being irreversibly retained and not released back into the process stream.



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- Pumps: caustic pumps, acid pumps, acid unloading pump, caustic make-up pumps.
- Complete Instrumentation and control system.

Testing & Quality Assurance

- Hydraulic and hydrostatic tests.
- Air leak and tightness tests.
- Welding qualification (WPS, PQR, welder certificates).
- Radiography, dye penetrant, and dimensional inspections.
- Coating and painting inspections.
- Full mechanical and process performance guarantee.

Services

- Full engineering, mechanical, and process design.
- Fabrication and assembly in Euroslot Pars workshop (Parand, Iran).
- Pre-inspection and technical meetings with the client.
- On-site support and supervision within 36 hours if required.
- Commissioning assistance and operator training.
- Guarantee: 12 months after commissioning (maximum 36 months from delivery).



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