

SPENT CAUSTIC TREATMENT



Refineries and petrochemical plants are now subject to stricter regulations on effluent discharge to prevent air and water pollution. Sodium hydroxide (caustic) remains a preferred substance for extracting harmful elements from hydrocarbon streams due to its safety, cost-effectiveness, and environmental friendliness. However, the discharge of spent caustic treatment solutions poses risks to water quality and aquatic life.



Efficient SPENT CAUSTIC Management

PANTAN's integrated solution offers sustainable handling and disposal for spent caustic. Our advanced process effectively diminishes contaminants to meet environmental standards for discharge to wastewater treatment plants (WWTP). This ensures compliance with environmental regulations and minimizes the environmental impact of the treated effluent.

PANTAN - Your Specialist
For Mass Transfer and Separation Technologies

Spent caustic is a waste water found in several units within oil and gas refineries and petrochemical plants

PDH Plants

Ethylene Plants

Refineries



Spent caustic is generated during the processes like treatment of LPG and gasoline. Sodium hydroxide is used to remove sulfur and other compounds from the oil, resulting in a waste stream known as spent caustic.

Ethylene plants produce spent caustic during the caustic scrubbing of cracked gas from an ethylene cracker. The product gas in these plants is contaminated with hydrogen sulfide (H_2S) and carbon dioxide (CO_2), which are removed by absorption in the caustic wash tower.

Propane Dehydrogenation plants generate spent caustic, which contains hydrogen sulfide along with some mercaptans, phenols, benzene, and emulsified-oils.

Conventional Methods Limitations in Spent Caustic Treatment

Incineration and Drying



- Contribute to air pollution like carbon footprint
- Requires high energy input

Biological Treatment



- Lead to microbial overload, elevated sludge production, disrupt biological processes
- Limited ability to eliminate all types of waste
- Slow Process

Chemical Oxidation



- High cost in large-scale
- Requires close attention to worker training and safe handling
- Potential formation of toxic byproducts

Electro-oxidation



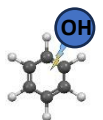
- Requires a significant amount of energy
- Fouling of electrodes
- High cost in large-scale

Neutralization and Stripping



- Limited ability to treat all types of components effectively

Advanced Oxidation Process (AOP)



- High expenses due to generation and utilization of ozone
- High expenses due to necessary equipment for fenton process
- High energy consumption for operation
- Production of potential harmful by-products
- Complexity and need for skilled operators

PANTAN's Integrated Spent Caustic Treatment Solution

Oil Removal

Are you facing operational challenges due to **Red-oils** in your process?

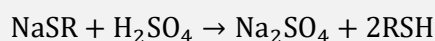
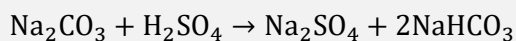
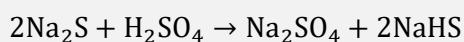
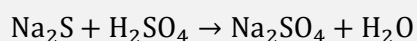
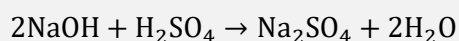
Ethylene Plants: In most ethylene plants, the caustic sections suffer from red-oils formation which results from the polyaldol condensation of some oxygenate species in basic media. These red-oils lead to solid material deposition which is generically referred to as fouling and which can cause severe energy losses or operational issue. Our innovative extraction process efficiently removes red-oils, preventing fouling and energy losses.

Refineries: Our optional package for refineries tackles oil in spent caustic, providing a comprehensive solution tailored to your needs.

Experience effective spent caustic treatment with our method involving sulfuric acid neutralization. This process forms sodium sulfate and other compounds, offering a safer and cost-effective alternative to other acids.

Ensure controlled environments due to potential heat generation and corrosive materials.

The neutralization of spent caustic may involve the following reactions:

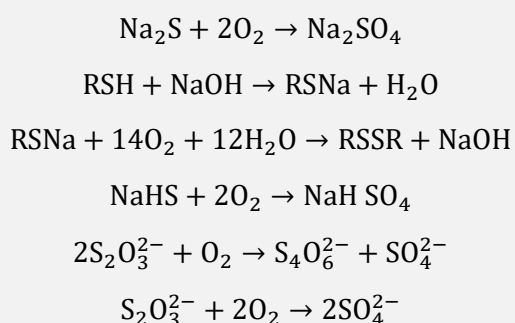


Neutralization

Wet Air Oxidation

Wet Air Oxidation (WAO) is an oxidation process that involves the oxidation of organic compounds in an aqueous phase using air at elevated temperatures and pressures. This process, with over 50 years of successful operation, is effective in breaking down complex organic pollutants into biodegradable by-products and reducing the chemical oxygen demand (COD) of the wastewater.

WAO minimizes the environmental impact by converting sulfides to less harmful sulfate ions. It also can be integrated into wastewater treatment systems, providing a sustainable approach to managing industrial effluents. The wet air oxidation of spent caustic may involve the following reactions:



Wet air oxidation can be conducted under various operational conditions of temperature and pressure, with or without the presence of different catalysts (homogeneous or heterogeneous).

The preference for non-catalytic WAO arises when simplicity, adaptability, and robustness are of primary importance, particularly when the waste stream comprises easily oxidizable components such as sulfides that do not require strict conditions (LP). For enhanced conversion of certain components, higher pressure and temperature WAO may prove beneficial (MP).

Alternatively, CWAO, catalytic wet air oxidation, may be a more suitable option when the waste stream contains challenging-to-degrade organic compounds, such as mercaptans, or when achieving high conversion rates is essential, and lower operational temperatures are preferred.

The selection between these methods should be based on a careful evaluation of specific waste stream characteristics, regulatory and environmental requirements, the availability of utilities, and economic considerations.

Table. Detail of PANTAN Spent Caustic Treatment Solution

Features	Spent Caustic LP Solution	Spent Caustic MP Solution
Operating Pressure	5-7 barg	15-20 barg
Operating Temperature	100 - 150 °C	150 - 200 °C
Reactor Material	CS, SS316L	Super Alloy
Na ₂ S As S ²⁻ Conversion	70 – 80 %	80 – 90 %
Utilities	LP steam, air, CW, H ₂ SO ₄ , Solvent, N ₂	MP steam, air, CW, H ₂ SO ₄ , Solvent, N ₂

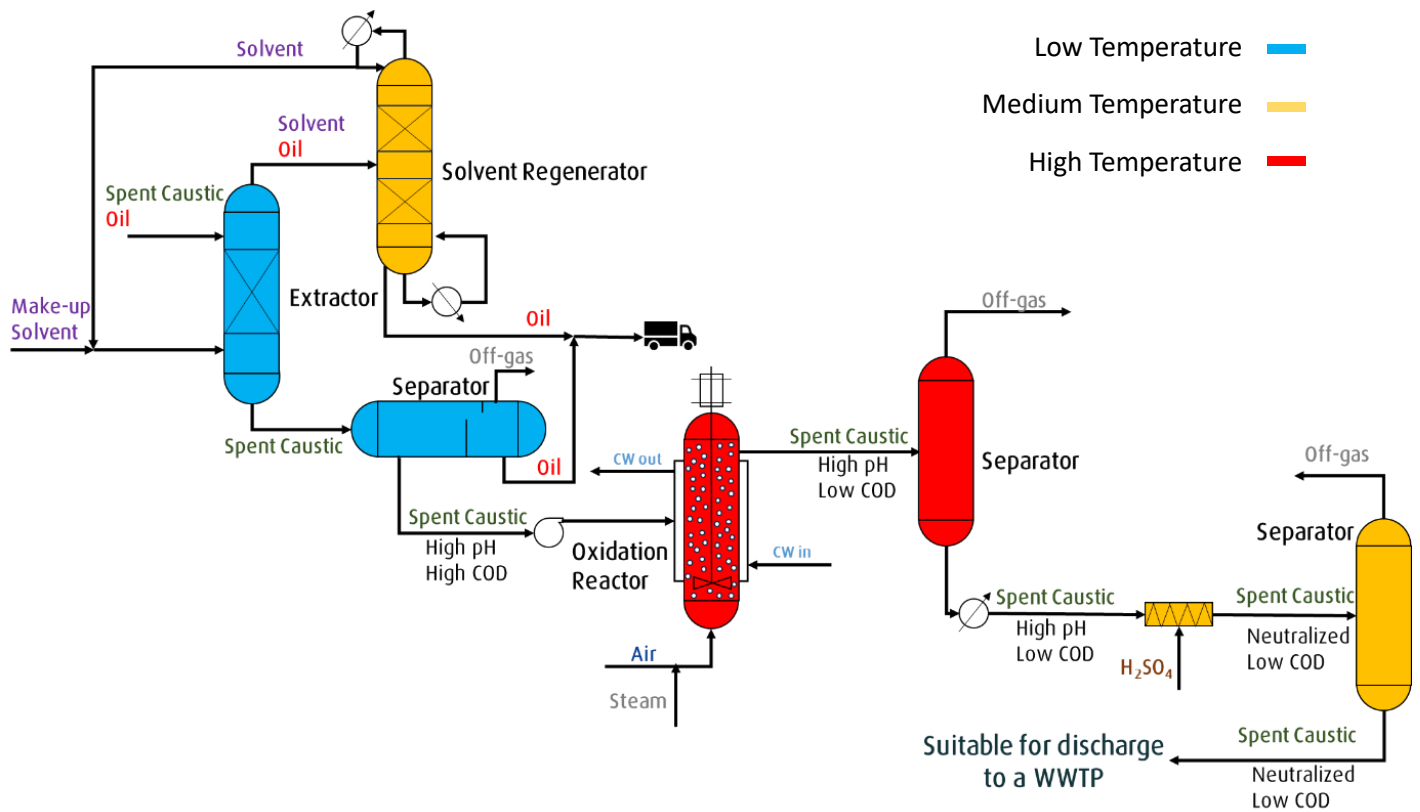


Fig1. Schematic of SPENT Caustic Treatment



Fig2. PANTAN's Spent Caustic Treatment Pilot

Our solution Features

Efficiency:



PANTAN's Spent Caustic Treatment solution is designed to oxidize inorganic Chemical Oxygen Demand (COD) such as sulfides in the spent caustic, significantly reducing COD. It can handle waste streams that are too dilute to incinerate and too concentrated for biological treatment.

Cost-effectiveness:



The technology provides a competitive balance between total installed cost and operating costs.

Environmental Impact:



With minimal environmental impact compared to traditional treatments, this solution offers several advantages:

1. Reduces Pollution
2. Energy Efficient
3. No Hazardous Byproducts
4. Sustainable Waste Management

With Spent Caustic Treatment solution, you're not just treating waste; you're also protecting the planet. Embrace a greener future with our technology.

Versatility:



Our solution can be used to treat in wide range of temperatures and pressures. It can handle a multitude of reactor designs and flow configurations, including the use of catalyst.

Customizability:

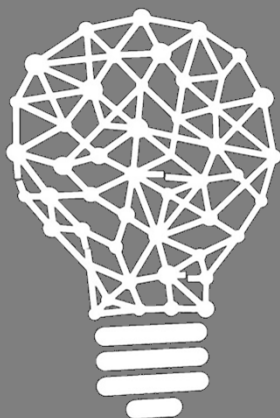


Spent Caustic Treatment solution systems can be custom-designed based on the specific needs and specifications of the industry, making it a flexible solution for a variety of applications.

At PANTAN, we go beyond the ordinary.

Need a tailored solution for your unique
process and product requirements?

Our dedicated team provide an **engineered solution**, based
on your specific case and requests as **your specialist**.



*Everything
Begins with
An idea*

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