

Making our world more productive



Wet Air Oxidation

One stop solution for your spent
caustic treatment



Building on expertise

Linde's

WAO

technology since 1970

Lowest

CAPEX

and optimised

OPEX

with standardised

plant solutions

Introduction

Since 1970, Linde Engineering has successfully executed several projects for the treatment of spent caustic effluents using a Wet Air Oxidation (WAO) process. This applies to the streams generated from Refinery and Petrochemical complexes, prior to sending them to common effluent treatment unit.

Linde is committed to provide its technology from concept to commissioning. Linde designs, supplies, constructs and provides after sales service for spent caustic treatment plants. Today, Linde is one of the leading global end to end solution provider for such plants.

Based on the environmental regulations, Linde selects either of the following process configurations to minimize investment and optimize operating cost.

- Low Pressure Process for treatment of spent caustic upto <10 wt PPM
- Medium Pressure Process for treatment of spent caustic upto <1 wt PPM

Further, Linde is experienced and has dealt with virtually every kind of spent caustic streams generated from:

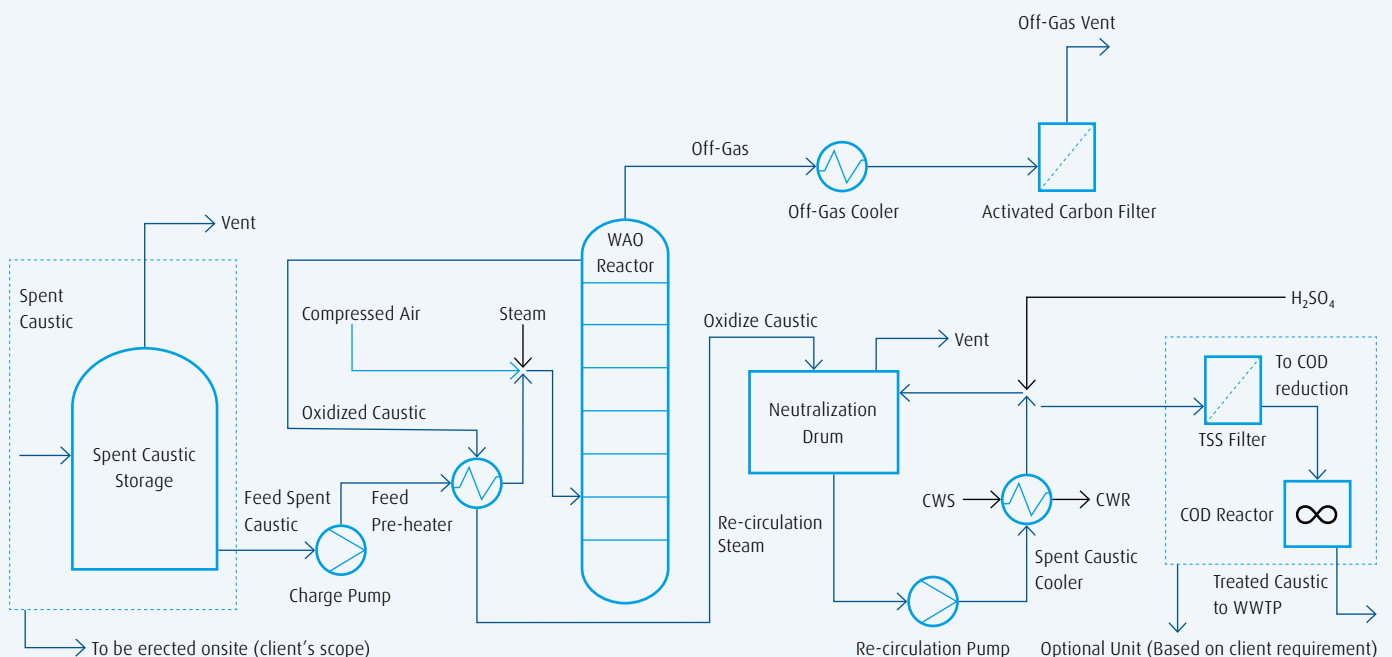
Petrochemical

- Ethylene Plant
- PDH Plant

Refinery

- Merox Unit
- Isomerization Unit
- DHDT and Hydrocracker Unit
- Propylene Recovery Unit
- Gasoline/Jet/Kerosene/LPG treating Unit

Linde's Typical Wet Air Oxidation Process (Low Pressure)



The WAO process for spent caustic treatment comprises of following process steps:

- Spent Caustic Storage tank to collect various continuous and intermediate streams with residence time for settling and skimming of hydrocarbons.
- Feed preheater to increase the desired reaction temperature of the feed stream.
- Oxidation reactor enables treatment of spent caustic using plant air and steam.
- Off Gas Cooler and activated carbon package to release vent gases for safe disposal.
- Neutralization section to maintain pH before routing treated spent caustic to effluent treatment plant.
- COD reduction package (optional) based on project specifications.

Fact Sheet of Linde Process Concepts

Features	Linde Spent Caustic LP Oxidation	Linde Spent Caustic MP Oxidation
No. of Equipment*	6-8	8-12
Operating Pressure	7 barg	35 barg
Operating Temperature	125 °C	200 °C
Feed/Effluent Heat	Yes	No
Reactor Material	CS, SS316L (internals)	Alloy 600
Na ₂ S as S ₂ -	<10 wt ppm	<1 w ppm
Utilities	LP steam, air, CW, H ₂ SO ₄ , N ₂	MP steam, air, CW, H ₂ SO ₄ , N ₂

* Depends on process concept selection and scope of work

Advantages of Linde Wet Air Oxidation Process

Environmental Regulation Compliance

Units are designed to meet environmental regulations both upto <10 wt PP < or < 1 wt PPM of Sulphides.

High Operational Reliability

Measured by the cumulative experience gained in the operation of spent caustic units. All plants installed since 1970 are still in operation with the exception of facilities that have closed.

Lowest Operating Cost

Linde's WAO process offers optimised operating cost at minimum Capex with low pressure process.

Prefabricated Modules

To reduce construction costs and logistics efforts, these units are offered in modularized skids.

Execution Concept: Pre-fabricated standardized modules

- Resulting in faster execution which adheres to schedule
- Improved quality and safety
- Reduced engineering effort and construction cost
- Limited period of site construction, minimize the site activities
- To avoid logistic challenges, containerize skids can be offered for special project locations
- Modular units compliant to codes and standards such as ASME, CE, KGS, etc.

Maximum

availability of plant operation

Options

for low and medium pressures processes



3 m³/hr spent caustic treatment plant for Indorama ventures Olefins LLC, Louisiana, USA



10 m³/hr spent caustic treatment plant for IOCL, Vadodara Refinery, India

Your partner for the production and processing of gases

Delivering reliable process plants for maximum capital efficiency

Linde has been optimizing gas processing technologies for 140 years, successfully delivering more than 4,000 plant engineering projects around the globe. Favoring trusted, lasting business relationships, the company collaborates closely with customers to enhance plant lifecycle productivity and innovate process flows. The company's proven gas processing expertise plays an indispensable role in the success of customers across multiple industries – from natural gas and oil refining through petrochemicals and fertilizers to electronics and metal processing.

Operational excellence along the entire plant lifecycle

We work closely with our customers to gain an in-depth understanding of individual needs. Building on the unique synergies of Linde as an integrated plant operator and engineering company, Linde offers innovative process technologies and services to exceed our customers' reliability and profitability expectations. This commitment to innovation extends along the entire plant lifecycle. The LINDE PLANTSERV® service team supports customers every step of the way – from maintenance and repairs to full revamps. Leveraging the latest digital technologies to offer on-site and remote operational and support services, we consistently take asset performance to the next level.

Making the impossible possible

From the desert to the Arctic, from small- to world-scale, from standardized to customized designs, Linde's engineering specialists develop solutions that operate under all conditions. The company covers every step in the design, project management and construction of gas processing plants and components. Customers can always rely on Linde to deliver the plants, components and services that fit their needs best – anywhere in the world.

Discover how we can contribute to your success at www.linde-engineering.com

Core competencies at a glance

Plant engineering

- Air separation plants
- LNG and natural gas processing plants
- Petrochemical plants
- Hydrogen and synthesis gas plants
- Adsorption plants
- Cryogenic plants
- Carbon capture and utilization plants
- Furnaces, fired heaters, incinerators

Component manufacturing

- Coldboxes and modules
- Coil-wound heat exchangers
- Plate-fin heat exchangers
- Cryogenic columns
- Cryogenic storage tanks
- Liquefied helium tanks and containers
- Air-heated vaporizers
- Water bath vaporizers
- Spiral-welded aluminum pipes

Services

- Revamps and plant modifications
- Plant relocations
- Spare parts
- Operational support, troubleshooting and immediate repairs
- Long-term service contracts
- Expert reviews for plants, operations and spare part inventory
- Operator training

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