



Optimizing Petrochemical

Wastewater Treatment

A guide to achieving compliant benzene levels with operational confidence

Engineered **Smarter**. Built **Modular**.

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Benzene Stripping

A Critical Step in Compliance

Reducing environmental pollutants has become a central focus for petrochemical plants, especially as regulations tighten. Among the most pressing challenges is the removal of benzene, a known carcinogen, from wastewater and process streams. At Koch Modular, we've taken significant strides in addressing this issue, developing robust and efficient benzene stripping systems that meet regulatory requirements and deliver operational reliability.

Our Proven Process

Leveraging steam stripping technology, Koch Modular has successfully designed and delivered over 30 benzene stripping systems, some which are capable of reducing benzene concentrations in wastewater to as low as 5 parts per billion (ppb). This approach is both effective and efficient, utilizing steam to volatilize benzene due to its lower boiling point and limited solubility in water.

The process begins with a detailed understanding of the feed stream's composition, often characterized by fouling properties that demand a durable design.

01

Preheating the Feed

Wastewater is preheated near its boiling point using heat exchange with the stripped effluent, ensuring energy efficiency.

02

Steam Stripping

Preheated feed enters the top of the stripping column while live steam is injected at the base. Steam effectively separates benzene from water, leaving behind a cleaner bottoms product.

03

Condensation & Separation

Overhead vapors, containing water and benzene, are condensed and separated into two liquid phases. Benzene is decanted off, while the aqueous layer is refluxed to the column.

04

Handling Inert Gases

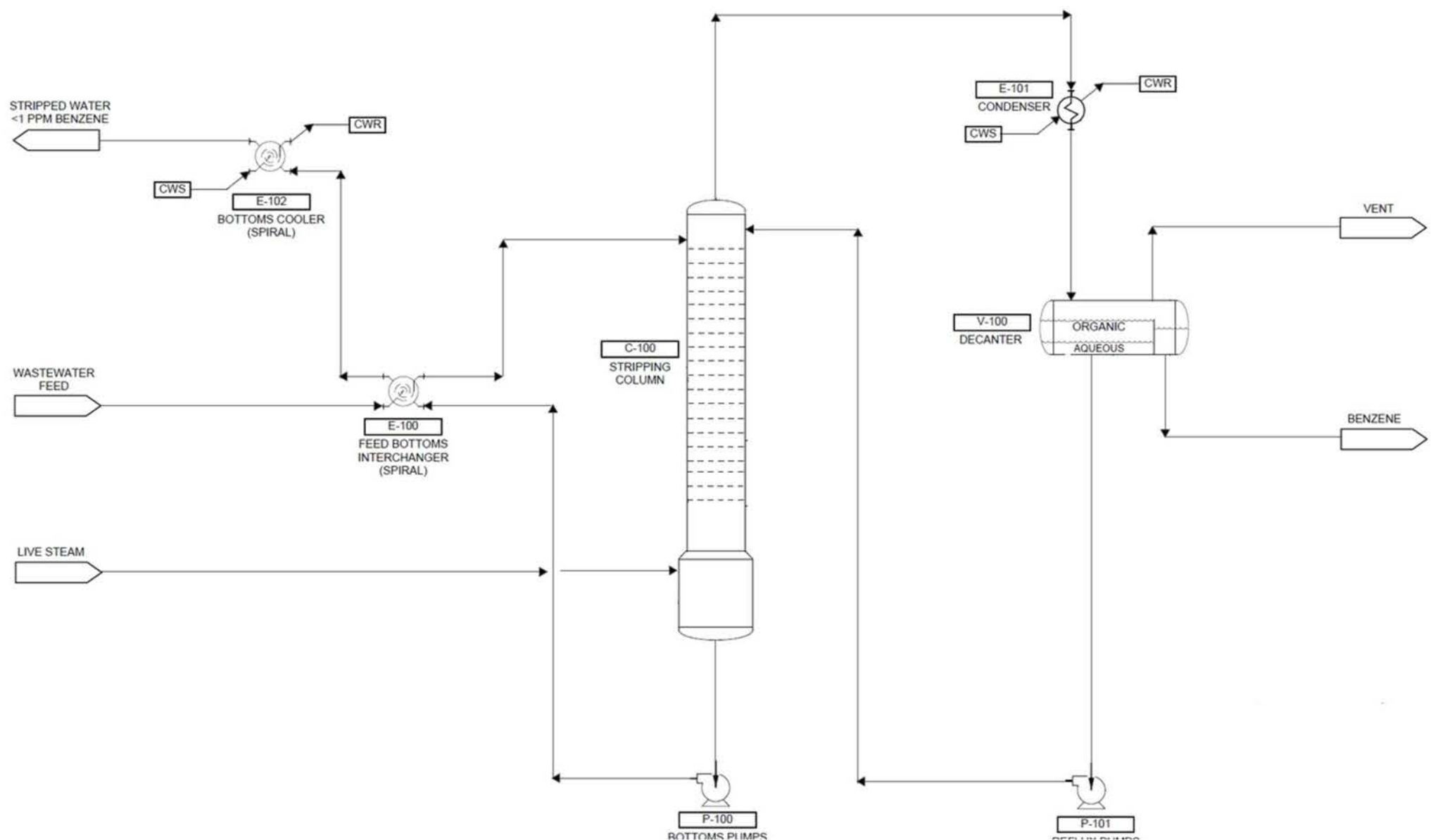
Stripped inert gases are routed to a flare header to maintain safe operations.

Benzene Stripping Process Flow Diagram

Achieve benzene levels as low as 5ppb

Engineering for Performance & Longevity

The physical properties of water, benzene's relative volatility, and the low concentration gradients present unique challenges in tray efficiency. Our systems are engineered to manage these challenges while maintaining continuous operation in demanding environments.





The Modular Advantage

At Koch Modular, we deliver our systems using a modular delivery model, integrating all components into road-transportable modules. This modular construction method offers several benefits:

30%

Reduced Costs

Lower installation and field construction expenses by 30% while mitigating risk, ensuring project predictability and cost certainty.

6-12M

Accelerated Project Schedules

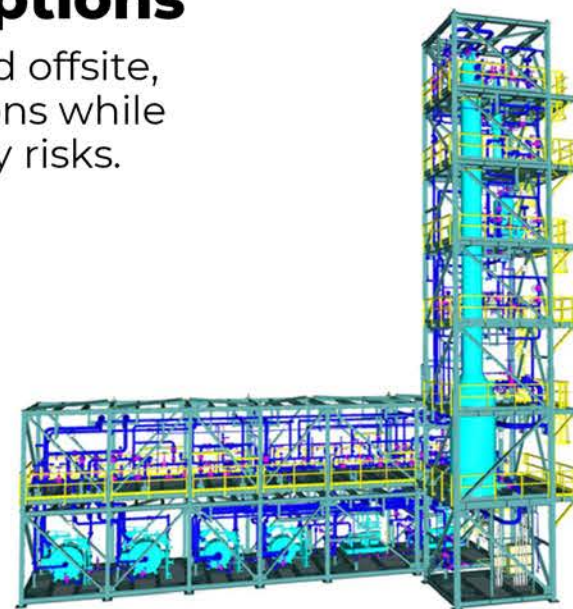
From concept to completion, our modular delivery model reduces project timelines by 6-12 months and enable simultaneous construction and permitting.

90%

Minimized Operational Disruptions

With 90% of construction activities conducted offsite, we minimize disruption of your daily operations while improving productivity and minimizing safety risks.

Each system includes structural steel, all process equipment, piping, field instruments, control systems, and insulation—fully compliant with client standards and specifications.

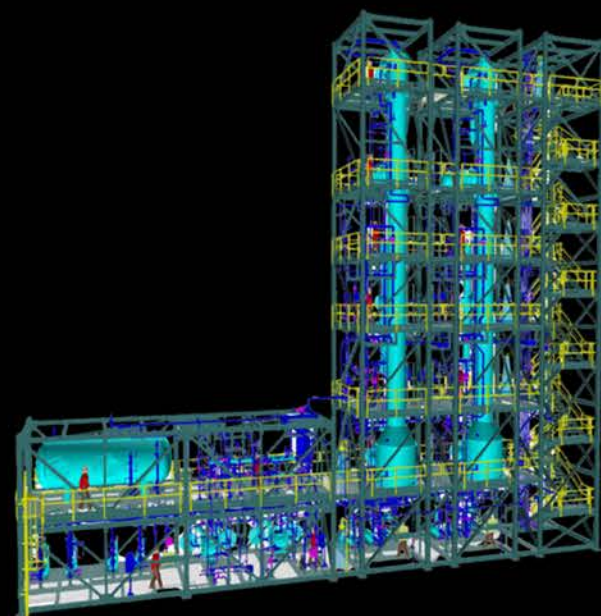


*Learn more about the challenges and solutions of benzene removal from ethylene plant wastewater on **page 6**.*

A Trusted Partner

From concept to commercialization, Koch Modular guides clients in developing an efficient process for benzene removal. By combining innovation with proven technology, we help petrochemical plants achieve environmental compliance while maintaining operational efficiency.

If you're looking for a trusted partner to optimize your wastewater and process waste streams, Koch Modular has the experience and expertise to deliver solutions that work.



Case Study

Spent Caustic Extraction and BTEX Stripper System

The client required a solution to remove fouling polymers from a spent caustic stream and strip Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) to meet strict environmental regulations. Achieving ultra-low BTEX concentrations was essential for compliance with discharge standards.

Challenge

The project involved addressing several critical challenges, including preventing fouling caused by polymer accumulation, selecting materials resistant to corrosion from the caustic salts, and achieving exceptionally low BTEX concentrations in the effluent, targeting levels below 10 ppb.

Solution

Koch Modular implemented a comprehensive, modular solution tailored to the client's specific needs. The system design began with liquid-liquid extraction to remove fouling polymers from the feed stream. The pretreated stream was then processed in a steam stripping column to remove BTEX. To ensure reliability and efficiency, fouling-resistant Koch-Glitsch fixed-valve trays were installed in the stripping column, and spiral plate heat exchangers were used to preheat the feed while minimizing fouling risks.

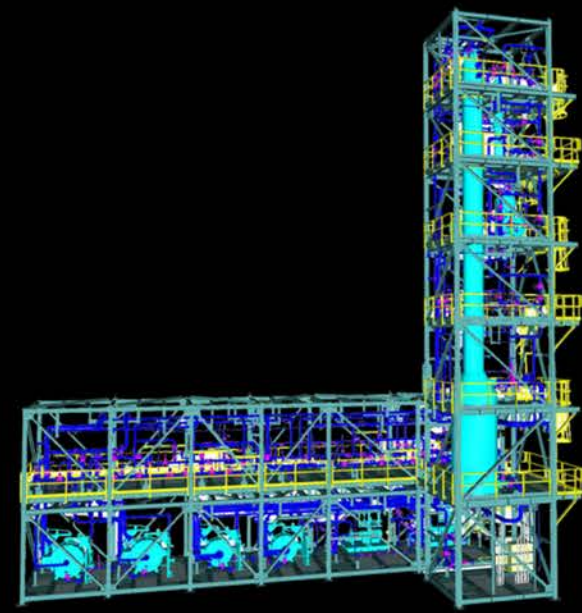
Duplex Alloy 2205 was selected for equipment in contact with the salty solution, providing excellent resistance to corrosion in this aggressive environment. Koch Modular's expertise in mass transfer design enabled the precise selection of tray efficiency to address the low concentration gradient and high liquid-to-gas ratio unique to this system. The entire system was constructed as pre-assembled, truckable modules. This modular approach will minimize on-site construction time and costs while ensuring quality control during fabrication. Modules were fully tested before delivery, allowing for seamless integration and expedited commissioning at the client's facility upon arrival.

Results

The modular system was designed to meet stringent EPA requirements, achieving BTEX concentrations well below 10 ppb in the stripped effluent. The incorporation of fouling-resistant technology and corrosion-resistant materials ensured continuous, reliable operation with minimal maintenance. Delivered in a modular format, the system offers the client significant advantages in terms of reduced installation timelines, lower construction costs, and enhanced operational efficiency. Koch Modular's experience-driven approach ensures a robust, efficient solution that met both environmental and operational goals.

Case Study

Benzene Removal in Ethylene Plant Wastewater



A client operating an ethylene plant required a solution to reduce benzene concentrations in wastewater effluent to meet strict environmental regulations. Achieving ultra-low benzene levels was a critical requirement for compliance.

Challenge

The project posed significant challenges, including the need to prevent system fouling and achieve exceptionally low Benzene concentrations in the stripped effluent. The system was designed to target benzene levels of less than 0.1 ppm while operating at a high flow rate of 200 gallons per minute.

Solution

Koch Modular designed and delivered a modular system to address the client's requirements efficiently and reliably. The process involved steam stripping the wastewater to remove benzene and other hydrocarbons effectively.

To mitigate fouling risks, fouling-resistant Koch-Glitsch fixed-valve trays were installed in the stripping column to prevent solids accumulation. Spiral plate heat exchangers were used to preheat the feed stream by recovering heat from the boiling effluent, reducing fouling risks and enhancing energy efficiency.

Leveraging experience with the design of multiple Benzene stripping systems, Koch Modular accounted for the precise mass transfer efficiency, resulting from the high relative volatility, low concentration gradient, and high liquid-to-gas ratio. This expertise informed the selection of optimized tray efficiency, ensuring the system could meet the required benzene removal performance.

The entire system was pre-assembled as truckable modules, tested for quality and functionality before delivery. The modular design minimized on-site construction time and costs while ensuring rapid installation and commissioning at the client's facility.

Results

The modular system was designed to consistently meet stringent regulatory requirements, achieving benzene concentrations well below 0.1 ppm in the stripped effluent. The integration of fouling-resistant trays and spiral plate heat exchangers is expected to ensure continuous, reliable operation with minimal maintenance needs. By combining advanced separation technology with a modular delivery model, Koch Modular provided the client with a cost-effective, efficient solution that facilitated compliance and enhanced operational performance.