

UOP Refining Adsorbents



**Delivering solutions
for separation and purification**



Operate profitably while meeting market demand

From shifting fuel demands, to stricter product specifications and environmental regulations, the refining industry is evolving at a rate many refineries are finding difficult to keep up with.

Product demand is shifting away from gasoline and residual fuel oil in favor of middle distillates such as naphtha, diesel and jet fuel. Processing more unconventional oils, and the contaminants that come with them, brings more challenges to the present-day refiner, including downstream equipment corrosion, catalyst poisoning and the formation of green oils. Tighter environmental regulations also dictate that upgrades in refinery technologies are necessary; however, many refineries are not equipped to meet the operational standards required to stay competitive.

Adsorbents

UOP has been a leader in providing quality products and services to the refining industry for nearly 100 years.

Our adsorbents remove a variety of contaminants within various refinery processes, including:

- Catalytic Reforming
- HF Alkylation

- Isomerization
- Light-Ends Fuel Recovery
- Ethylene Production
- Sulfur Recovery

UOP's portfolio of active alumina adsorbents can help your operation run more efficiently by removing many contaminants, including:

- Hydrogen Sulfide
- RSH
- Carbon Dioxide
- Carbonyl Sulfide
- Hydrogen Fluoride
- Chlorine
- Mercury
- Arsine
- Oxygenates/Water

Cleaner product streams increase the value of your products, ensure the safety of your employees and support the long-term operation of your facility's equipment, contributing directly to your bottom line.

Discover how UOP's alumina adsorbents solutions can help improve the quality of your products and increase the efficiency and profitability of your operation.

Optimize your operation

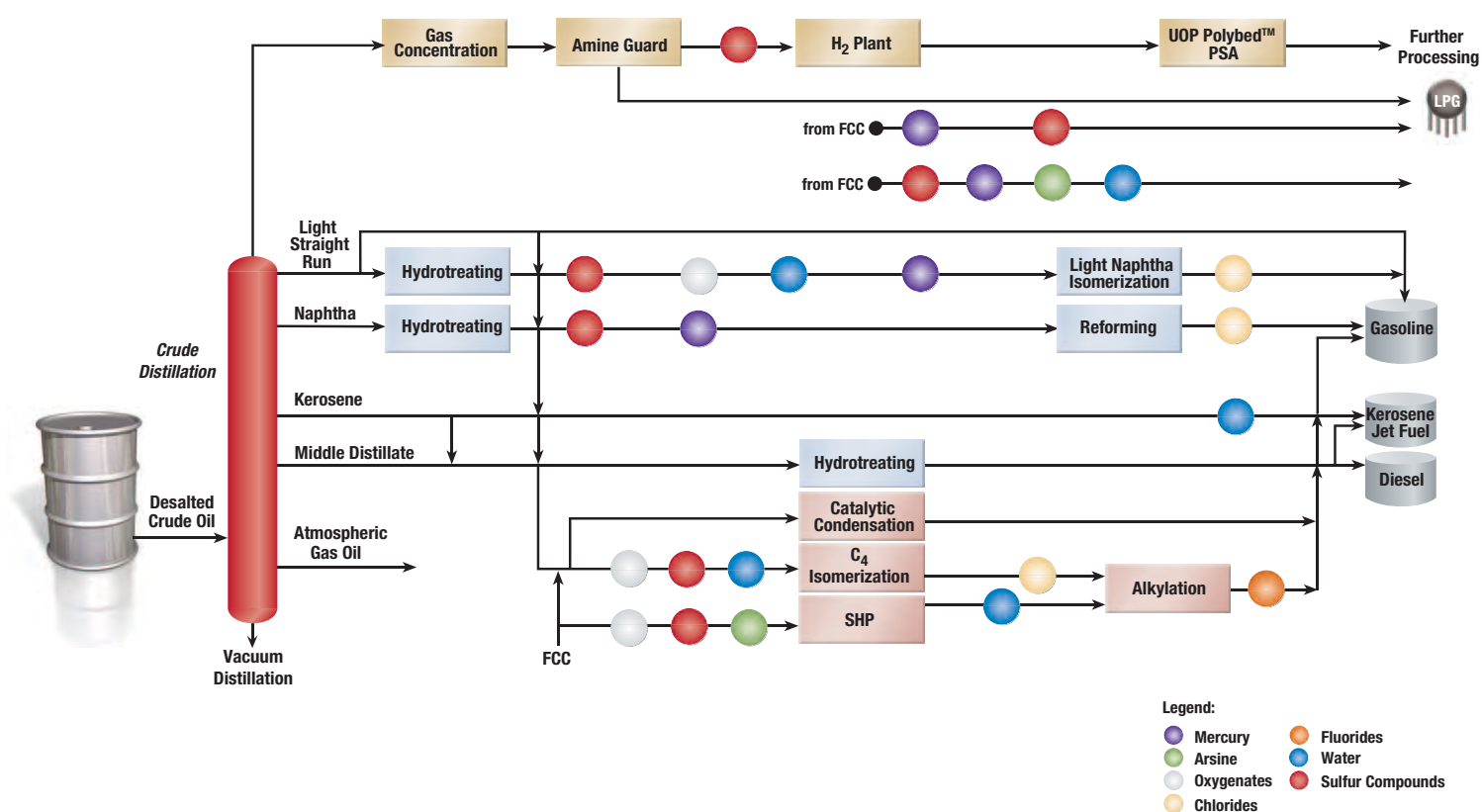
UOP's advanced portfolio of active alumina adsorbents is specifically designed to address the critical issues that affect the refining industry most. Regardless of where the plant is located, refineries around the world are addressing many of these same issues:

- Managing environmental concerns
- Ensuring plant personnel's health and safety
- Protecting critical process equipment
- Preventing the deactivation of process catalysts
- Meeting product specifications
- Maximizing profits



Safely remove
contaminants
that poison your
catalyst beds.

Adsorbent locations for contaminant removal



Simply fit and forget

UOP's "fit and forget" adsorbent technology is a no-worries start-up solution that allows you to select the technology best fit for your needs, and forget about adding chemicals for optimum adsorbent performance. The process is simple, saving you time and money.

How it works

Operators monitor process parameters and stream composition, simplifying contaminant removal. Once the adsorbent meets optimum capacity, it is unloaded and replaced with fresh adsorbent. Using this technology, UOP can now deliver guard beds with higher capacities and longer lifetimes, reducing spend to remove the same unit weight of a range of contaminants.

"Fit and forget" technology requires less equipment, utilities consumption and capital to operate over other adsorbent technologies, and due to the low reactivity of UOP adsorbents, no preconditioning or activation step is necessary prior to use.



Contaminant removal

UOP is at the forefront of investigating new and improved adsorbent technologies that more safely, efficiently and cost-effectively remove harsh contaminants from refinery operations. The adsorbents' team is committed to answering your questions, helping you discover new opportunities and working to resolve the challenges that face your operation every day.

● **Sulfur** naturally occurs in most hydrocarbons. Modern high-activity catalysts are extremely sensitive to sulfur poisoning, and emission standards have been tightened as have refined product quality requirements.

- In wet environments, sulfur can cause corrosive damage to equipment and piping
- Sufficiently high sulfur levels in refinery streams can:
 - Deactivate the catalysts that promote desired chemical reactions in certain refining processes
 - Cause corrosion in refinery equipment
 - Lead to air emissions of sulfur compounds

Solutions: UOP ADS-120, UOP ADS-130, UOP ADS-280, UOP SG-731

● ● **Oxygenates/Water** levels vary from ketones, aldehydes, alcohols and ethers. Polymerization and isomerization catalysts are extremely sensitive to poisoning by these compounds.

Solutions: UOP AZ-300, UOP GB-620, UOP MOLSIV™ ADG-401, UOP MOLSIV™ HPG-250

● **Mercury** is found in most crudes and is common to naphtha, diesel and C₃ fractions. It is a proven catalyst poison and a danger to process equipment.

- Mobile and capable of adsorbing/desorbing to-and-from pipe work and other assets
- Reduces the value of export naphtha
- Has a high vapor pressure and will distribute into lighter products and gaseous streams
- Causes cracking of copper-based trays or valve components and corrosion of Al surfaces
- Cause troublesome contamination, maintenance or cutting of mercury contaminated steel surfaces

Solutions: UOP GB-346, UOP GB-346S

● **Fluoride** is present in HF alkylation units. HF alkylation catalyst will form organic fluoride via reaction with olefins.

- Corrosive by nature
- Defluorination of butane, propane and alkylate streams is very common

Solutions: UOP P-188, UOP A-202HF

● **Chloride** is found in isomerization operations and is an activating agent for reforming catalysts.

- Process strips away HCl, requiring further, continuous or discrete additions of Cl
- Lost Cl leaves the reformer loop in the make-up gas and off-gas streams
- Cl causes fouling and corrosion, reduces adsorbent life and deactivates catalysts

Solutions: UOP CLR-204, UOP CLR-300, UOP CLR-454

● **Arsine** is present in most crudes, especially in C₃ fractions. Polymerization catalysts are also sensitive to poisoning by Arsine.

- Reduces value of C₃ product to downstream petrochemical processors
- Less than 1ppm of Arsine is enough to poison the selective hydrogenation catalyst

Solution: UOP GB-238



Customer experience

Case Study A Providing a safer and easier to use adsorbent	Case Study B Extending the life of a chloride guard bed	Case Study C Improving cost efficiency of a fluoride guard	Case Study D Protecting process catalyst from multiple poisons
Situation A plant in Europe was concerned with the significant cost of handling, disposing and replacing a nickel-based adsorbent. If handled improperly, nickel carbonyl, a highly poisonous gas, may form when a Ni-type compound is exposed to air. To ensure plant safety, extreme care must be taken. UOP solution UOP's service team reviewed the customer's operation and environmental concerns, and recommended UOP's ADS-120 copper/alumina mixed metal oxide. Customer benefits Changeover and adsorbent disposal has been greatly simplified and metal utilization enhanced, producing a more robust product that better resists sulfur upsets. UOP's adsorbent solution also increased the life of the adsorbent by 18%.	Situation A plant in Asia Pacific running a net gas treater reported chloride slip in their hydrogen stream, causing equipment corrosion. The existing adsorbent required change-outs several times a year. UOP solution To alleviate downtime spent replacing equipment, UOP's specialists reviewed the stream's contents and successfully identified the chloride compounds causing the equipment corrosion. The team recommended UOP's high-capacity CLR-204 adsorbent. Customer benefits UOP's adsorbent solution increased the life of the adsorbent by more than 45%, reporting no chloride slip or equipment failures due to corrosion. This unit has been operating at peak levels since the change.	Situation An HF Alkylation unit in the Americas was experiencing excessive hydrocarbon coking resulting in a shortened adsorbent life cycle. UOP solution UOP's P-188 adsorbent was recommended and placed in the customer's adsorption unit after analysis of operating conditions and characterization of the feed stream. Customer benefits After successful implementation of UOP's adsorbent solution, the unit's capacity increased by 34%. Coking has been significantly reduced, increasing the time between required change-outs.	Situation A plant in the Pacific Rim suffered from a precious metal catalyst deactivation and required periodic heat treatment to desorb the contaminants. This resulted in a steady sintering of the active phase of the catalyst. UOP solution UOP's technical service team evaluated the catalyst and identified arsine, H₂S, and mercury contaminants as the cause of the deactivation. A bed of UOP's GB-346 and GB-238 was installed, successfully removing the contaminants and increasing catalyst life. Customer benefits The requirements for catalyst heat treatment have been eliminated, and the catalyst has maintained its expected conversion.

Unparalleled experience to service and support all your adsorbent needs

UOP has been a recognized leader in the adsorbent industry for more than 60 years. From inventing the first commercially produced synthetic zeolites, to developing a range of innovative, copper-promoted alumina products, UOP's portfolio of advanced adsorbents technologies continues to grow.



Today, UOP offers the broadest portfolio of adsorbent solutions, specifically designed to improve the quality of your products and increase the efficiency and profitability of your operation.

With more than 2,100 active patents worldwide, our research and development efforts continue to drive important advances in process and refining technology. Count on UOP as your single source for the products, processes, services and in-depth industry knowledge that you need.

The Adsorbents Technical Service Team is made up of some of the industry's most experienced consultants and best-equipped troubleshooters, backed by nearly 60 years of adsorbent research, production and application knowledge. With more than 500 customers in 120 countries, UOP has the global reach to meet the needs of our clients anywhere

from Houston to Dubai. We're committed to providing service that will help you foresee potential problems before start-up, get you on-stream faster and keep you running year after year at peak performance.

Our expertly-trained and dedicated service team specializes in the following:

- Process design to determine optimal configuration and operating conditions for your application
- Start-up assistance to ensure on-time and effective product implementation
- Performance evaluations to facilitate preventative action
- Troubleshooting to diagnose problems
- Operations analysis to help improve your productivity and profitability utilizing world-class UOP laboratory, pilot plant and simulator resources

Find out more

The contents in this brochure are both Alumina and Molecular Sieve based. For more information on these products, please contact your UOP sales representative or visit us online at www.uop.com.



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