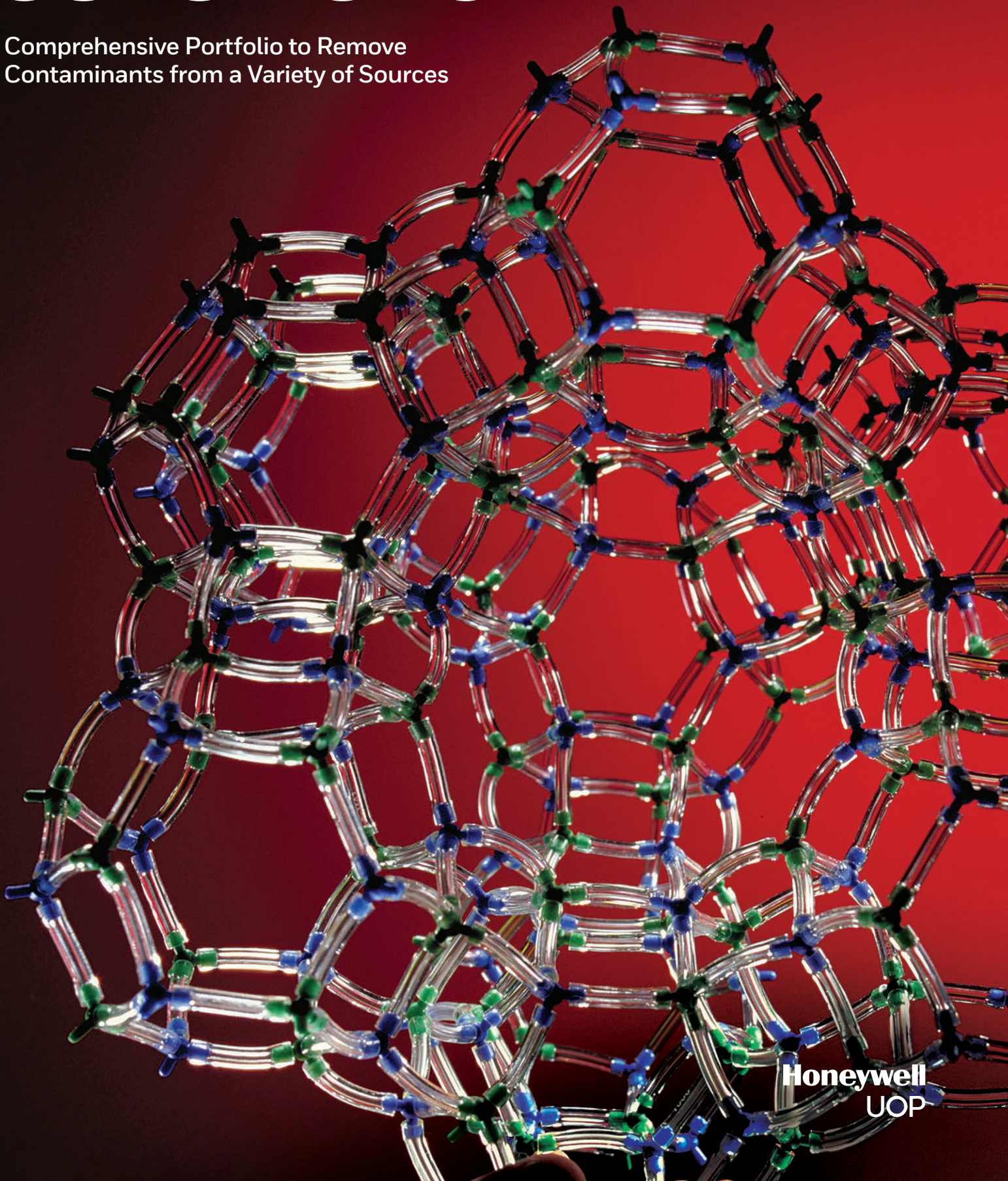
UOP ADSORBENT SOLUTIONS

Comprehensive Portfolio to Remove Contaminants from a Variety of Sources



Honeywell
UOP

WHEN YOU INVEST IN UOP ADSORBENTS, YOU GAIN MORE THAN SIMPLY A CONTAMINANT REMOVAL PRODUCT.

You gain a comprehensive team of experts dedicated to designing and producing a custom solution for you. You gain years of industry experience and operating knowledge. You gain unparalleled technical service and, most importantly, the confidence that your valuable operation will run more smoothly and with fewer problems.

FIRST-TO-MARKET ADSORBENTS TECHNOLOGY

UOP pioneered the Adsorbents industry with the invention of the first synthetic zeolites for use as molecular sieves in 1949.

This important discovery revealed that the zeolite's crystalline structure adsorbs molecules readily, slowly or not at all, and has the ability to selectively adsorb by size and polarity, making them efficient agents for drying and purifying liquids and gases.

By tailoring the chemistry and structure of the materials used to create synthetic zeolites and our comprehensive alumina product line, UOP provides custom solutions to meet a wide range of needs, including:

- Helping prevent unwanted reactions in process streams or complications from equipment corrosion or freeze-up
- Helping meet product specifications
- Dehydration to water content less than 0.1ppm
- Low reactivity adsorbents to reduce side reactions
- High capacity for water even at temperatures above 200°F (93°C)
- Regenerative and non-regenerative adsorbent solutions
- Purification and dehydration in one operation
- Dehydration without adsorbing valuable product or altering the feed composition
- High product recovery
- Infrequent recharges through numerous purification and dehydration cycles due to the reversible adsorption process of zeolites
- High cyclic capacity with sufficient thermal or pressure swing purging
- Protect catalyst beds from deactivation/ poisioning

For more than 60 years, we have continued to be a reliable product and service supplier. Over that time, UOP's offering has continually improved to address the changing needs and growth of our customers' operations.



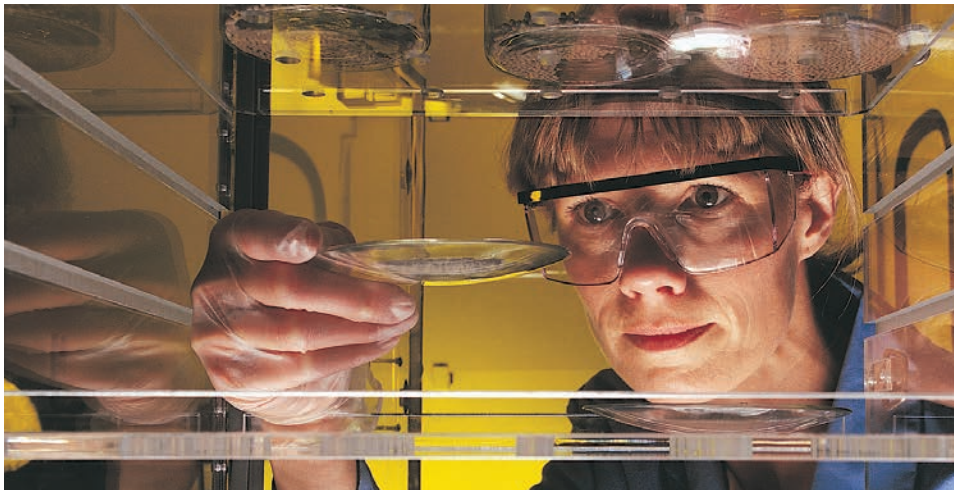
Zeolite molecular sieves' strong attraction for water makes them the ideal adsorbent for gas and liquid streams where ppm effluent dehydration is required

Today, we offer the broadest portfolio of adsorbent products in the widest variety of packages. Our longevity in the industry and understanding of product application can help you achieve the highest performance to meet your business objectives.

MANUFACTURING CAPABILITIES

With production facilities in the United States, Italy, Japan and China, UOP is committed to providing the right product at the right time. We are the worldwide leader in the development and manufacturing of adsorbents, and we offer a variety of formulations and packages, including: pellets, beads, granules and powders.

UOP MOLSIV™, TRISIV™, OXYSIV™ and other adsorbents products are chosen by more customers around the world than any other adsorbent products.



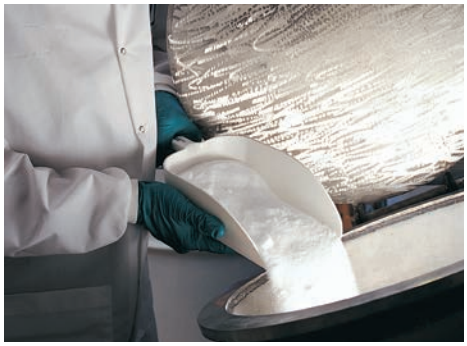


Multiple bed adsorption for H_2O and CO_2 removal from natural gas before methane liquification.

OUR COMMITMENT TO CONTINUAL INNOVATION

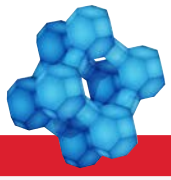
Since the invention of the first molecular sieve in the 1940's, research and development has been the cornerstone for UOP adsorbents. Our success, and the success of your business, rests on our commitment to continually develop innovative, reliable, high-performing products to meet your current and future needs.





Used successfully in hundreds of commercial systems for drying and purifying liquids and gases, UOP molecular sieves and aluminas are the most universally applicable adsorbents in the process industries.

UOP ADSORBENTS FOR A VARIETY OF INDUSTRIES AND APPLICATIONS



APPLICATION	ROLE OF MOLECULAR SIEVES AND ALUMINAS
Air dryers	• Dehydration of plastic pellets before they are molded • Dehydration for instrument air • Dehydration of room air with adsorbent impregnated dessicant wheels
Oxygen concentrators for respiratory patients	• Adsorption of nitrogen from air using a pressure or vacuum swing system to obtain oxygen purity up to 95%
Air brakes	• Dehydration of compressed air on brake systems of heavy- and medium-duty trucks, buses and trains • Pressure swing dryers are used to reduce the dew point of air in the brake reservoir below ambient temperature to prevent freeze up and corrosion
Insulated glass (dual-pane windows)	• Removal of initial trapped moisture inside the dual pane window and the moisture that will permeate during the life of the unit to prevent fogging • Removal of vapors from organic sealing materials, paint and cleaning solvents introduced during window manufacture
Polymer formulations	• Dehydration of moisture sensitive formulations – added to poly coatings, epoxies and urethanes to control the curing process and coatings, adhesives, sealants, elastomers, metal rich paints and vinyl foams to eliminate unwanted water reactions
Radioactive cleanup	• Removal of radioactive nuclides by ion exchange – cesium and strontium are exchanged preferentially into the zeolite molecular sieves to greatly reduce the volume of radioactive waste
Refrigeration and air-conditioning (A/C) systems	• Dehydration of automotive A/C, transport refrigeration, home refrigerators, freezers, residential A/C, heat pumps and commercial refrigerants to prevent freeze up and corrosion • Dehydration to protect system materials from adverse chemical reactions
Deodorization	• Removal of odor or taste from personal care products and plastics with high silica (hydrophobic) zeolite molecular sieves. Odors are adsorbed, not masked
Package dehydration	• Dehydration with zeolite molecular sieves when very low humidity conditions are required. Small desiccant packets or tablets protect products such as pharmaceutifcals, medicaldiagnostic reagent kits, vitamins, food, candy, batteries, dry fuel propellants, machine parts, film and instruments
Air separation	• Removal of water and carbon dioxide from air before liquefaction and cryogenic separation of nitrogen, oxygen and other atmospheric gases • Separation of oxygen and nitrogen with pressure swing or vacuum swing adsorption systems • Sulfur removal for high purity food grade CO_2
Natural gas	• Dehydration before cryogenic recovery of natural gas liquids and helium • Dehydration of high acid gas content (CO_2 and H_2S) natural gas and natural gas condensate streams • Removal of sulfur compounds from ethane, propane and butane • Removal of water and CO_2 before methane liquefaction • Removal of water and sulfur compounds to protect gas transmission pipelines • Dehydration of natural gas liquids • Desulfurization of feed streams for ammonia and other chemical plants • Removal of mercury, preventing damage to aluminum heat exchangers
Petroleum refining	• Dehydration of alkylation feed, refinery gas streams prior to cryogenic separation, naphtha and diesel oil • Purification of feedstocks to protect isomerization catalysts • Removal of water, HCl and H_2S from reformer streams • Removal of oxygenates from etherification raffinate streams and alkylation feed • Removal of HF and organic fluorides • Removal of H_2S to meet copper strip test for pipeline transportation • Removal of nitriles from etherification feed • Dehydration of ethanol • Dehydration and desulfurization of LPG streams • Separation of normal paraffins from branched chain and cyclic compounds • Purification by pressure swing adsorption for upgrading hydrocarbon streams • Removal of Hg
Petrochemicals	• Dehydration and purification of NGL/ethane/propane feed • Dehydration of cracked gas, C_2 and C_3 splitter feed and hydrogen • Low reactivity adsorbents for polymer streams • Dehydration and purification of salt-dome-stored ethylene, propylene and various other feedstocks • Removal of water, carbon dioxide, methyl alchohol and other oxygenates, hydrogen sulfide and sulfur compounds, ammonia and mercury from ethylene, propylene, butylenes, amylenes and various solvents and co-monomers • Removal of Hg, O_2, CO_2, H_2S and/or COS
Volatile organic compound removal	• Removal of trace volatile organic compounds from air streams • Removal of volatile organic compounds from moisture-laden process streams

UOP ADSORBENT MILESTONES



Development of GB series adsorbents for contaminant removal



Development of the high-capacity, activated-alumina AZ and CLR product lines

Purchase of LaRoche alumina manufacturing plant



Advanced PSA/VSA products for oxygen production introduced

Union Carbide's MOLSIV adsorbents group becomes part of UOP



UOP ABSCENTS™ deodorizing powders developed to eliminate odors from plastic packaging and other consumer products



MOLSIV detergent builders replace phosphates in detergents



Zeolitic catalysts used in gasoline production

MOLSIV adsorbents used to keep refrigerant dry in automotive air conditioners



Normal and iso-paraffin separation achieved with shape selective MOLSIV adsorbents

Work begins on zeolite catalysts for the petroleum refining industry





Union Carbide develops and patents the first commercially significant synthetic zeolites, MOLSIV adsorbents

2000

1990

1980

1970

1960

1950

1949

Continuing evolution of medical oxygen and air separation products



UOP introduces dozens of new MOLSIV adsorbents, including products for the refrigeration industry to meet the Montreal Protocol requirements for non-CFC replacement refrigeration systems



Development of HgSIV adsorbent for regenerative mercury removal



MOLSIV adsorbents used to help clean up nuclear waste at Three Mile Island in Pennsylvania, USA



MOLSIV adsorbents used in home medical oxygen concentrator units



MOLSIV adsorbents used to eliminate moisture between the panes of dual pane windows



Natural gas and ethylene plants use MOLSIV adsorbents for dehydration

MOLSIV adsorbents used to remove sulfur from propane (LPG)



The first commercial use of MOLSIV adsorbents – reducing moisture in home refrigerator systems to keep them operational



UNPARALLELED EXPERIENCE TO SERVICE AND SUPPORT ALL YOUR ADSORBENT NEEDS

GLOBAL SERVICE AND SUPPORT FOR YOUR ADSORBENTS NEEDS

We offer unparalleled service and support to help ensure you maximize the use and life of your UOP adsorbents.



Our highly trained and experienced staff is positioned around the world, and dedicated to quickly and efficiently meeting your business needs. Some of the services you can expect, include:

- Process design to determine optimal 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

For More Information

If you are interested in learning more about UOP adsorbents please contact your UOP representative or visit us online at www.uop.com.

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OUR COMMITMENT TO SUSTAINABILITY

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