

ZEOCHEM®



Zeochem Molecular Sieve Adsorbents  
**Natural Gas**  
**Natural Gas Liquids**  
**Liquefied Natural Gas (LNG)**

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Chemistry. Pure. Efficient.

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# ZEOCHEM

Zeochem is a premier global manufacturer of molecular sieve products. With our roots in Switzerland, we have a culture of quality and customer service. As such, Zeochem provides excellent, responsive service, high-quality products, and the expertise to help you find the product and service solutions you need.



Zeochem's technical sales and service teams have decades of experience and are available to answer operational questions, troubleshoot units and find solutions for your dehydration and treating needs. Our team of industry experts provides product recommendations and designs that optimize performance and improve the reliability of your units. We consider our customers as partners throughout the life of the sieves and pride ourselves on our responsiveness.

With manufacturing facilities in Louisville, KY, USA and Donghai, China, Zeochem offers a range of high-performance products and global support. Timely answers and troubleshooting are provided by our sales and technical experts located strategically around the world.

**Consistent.**

**Responsive.**

**Innovative.**

*“We consider our customers as partners throughout the life of the sieve and pride ourselves on our responsiveness to our customers.”*

# Applications

## Natural Gas Dehydration

For decades, natural gas dehydration plants have been operating worldwide utilizing a variety of technologies. Gases dehydrated range from straight natural gas to heavier associated gases including sour gases of various types. Many cryogenic natural gas processing plants use turbo-expander technology to compress, chill and liquefy the natural gas to enable heavier and more valuable components (natural gas liquids) to be separated from the feed gas. To process the gas streams without hydrate formation or freeze-ups, these plants depend upon molecular sieves to remove water to very low levels (1 ppmv or less). LNG plants require even lower moisture levels as do plants where ethane recovery is desired. Molecular sieve dehydration is the only technology that can achieve the required very low moisture levels. Selecting a high-quality molecular sieve with good durability, kinetics and capacity is key for prolonging the life of the sieve and extending the time between reloads.

## Natural Gas Liquids

Zeochem offers a number of long-lasting molecular sieve dehydration products for natural gas liquid (NGL) fractionation plants. These products are used to treat the incoming feed streams prior to cryogenic fractionation, allowing the various liquid hydrocarbons to be separated and meet final product specifications. Our robust molecular sieve products are used for a range of liquid streams, including condensate, propane, butane, isobutane, pentane and hexanes+.

## Liquefied Natural Gas (LNG)

LNG plants use liquefaction of natural gas similar to cryogenic natural gas processing plants. In order to process the gas streams at extremely low temperatures without hydrate formation, these plants depend upon molecular sieves to remove water to very low levels (0.1 ppmv or less). Zeochem molecular sieves have a controlled pore structure, high hydrothermal stability, high adsorption selectivity, optimum physical strength, and excellent dynamic performance making them suitable in this challenging application. The durability and consistent quality of Zeochem molecular sieves make them the optimal choice to minimize the risk of moisture in downstream processes.

# ZEOCHEM MOLECULAR SIEVES

## Z3-06

Zeochem Z3-06 molecular sieve is a 3A type crystal recommended for dehydration of hydrocarbon gas and liquid streams. Our family of 3A sieves have the advantage of adsorbing water while excluding other molecules from the internal crystal lattice. By limiting penetration and co-adsorption of molecules such as hydrocarbons, carbon dioxide and sulfur compounds, Z3-06 offers a number of economic and technical advantages:

- Reduced regeneration temperatures, compared to standard 4A regeneration.
- Reduced hydrocarbon losses from the main gas stream to the regeneration stream when the regeneration stream is not recycled.
- More consistent and predictable product and regeneration stream compositions. This includes the minimization of contaminant and hydrocarbons spikes in these streams, which allows for more consistent operation of downstream cryogenic units.
- Reduced formation of carbonyl sulfide (COS).

In addition, Z3-06 minimizes coking, as well as sulfur and oxygen side reactions, thereby extending the life of the sieve. This is of particular benefit when oxygen is present in feed or regeneration streams.

## Z4-04

Zeochem Z4-04 molecular sieve is a 4A type crystal structure, which is particularly suitable for use in natural gas dehydration plants and similar processes. The combination of an open crystal structure and a high equilibrium capacity for moisture, together with strong dynamic characteristics and physical properties makes Z4-04 a wise choice for natural gas dehydration. It is approved and in use with major natural gas processing companies around the world. This product is also used for the removal of small oxygenates, such as methanol, from hydrocarbon streams.



## Z3-02

Zeochem Z3-02 molecular sieve is a modified form of 3A, which is suitable for reactive streams including offgas, ethylene, and propylene. By selectively adsorbing water and limiting co-adsorption of the more reactive compounds, Z3-02 can minimize coking, which extends the life of the sieve. In natural gas applications, when H<sub>2</sub>S and CO<sub>2</sub> are present, the use of Z3-02 can reduce COS formation.

### **The Formation of Carbonyl Sulfide (COS) on Molecular Sieve**

Z3-02 is ideal for applications where COS must be limited. The presence of carbon dioxide, hydrogen sulfide and moisture in a gas or liquid can result in the formation of carbonyl sulfide.



This reaction is an equilibrium reaction. While the gas is saturated, the position of equilibrium will favor the presence of only a very small amount of COS. However, in an adsorber, as the amount of moisture is decreased through adsorption, the equilibrium shifts and the amount of COS formed will increase. The use of a modified form of 3A, such as our Z3-02, will not catalyze the COS formation reaction and will also minimize the co-adsorption of carbon dioxide (CO<sub>2</sub>) and hydrogen sulfide (H<sub>2</sub>S); hence, the maximum expected COS formation will be limited to around 5% of the equilibrium value.

## Z3-05HP

Zeochem Z3-05HP molecular sieve is a specially developed product with increased capacity which offers longer life and greater throughput. This increased capacity means that the size of new vessels can be reduced. This high-performance product is suitable for dehydration of hydrocarbon gas and liquid streams in specific types of units. As a member of Zeochem's family of 3A products, Z3-05HP has the advantage of excluding other molecules from the internal crystal lattice while still adsorbing water. In reactive streams, use of Z3-05HP can minimize COS formation in the presence of H<sub>2</sub>S and CO<sub>2</sub> and reduce coking, thus maximizing service life.

## Z4-05HP

Zeochem Z4-05HP molecular sieve was developed for use in streams that contain elevated levels of heavy hydrocarbons. Its unique formulation offers increased capacity and longer bed life when compared to standard 4A products. This high-performance product is particularly suitable for use in natural gas dehydration plants, LNG and NGL plants. This product is also used for removal of small oxygenates, such as methanol, from hydrocarbon streams. Our Z4-05HP has an open pore structure, giving it excellent equilibrium and dynamic performance, along with optimum physical strength and high hydrothermal stability. For cases where coadsorption of sulfur compounds and CO<sub>2</sub> in the feed is not a concern, Z4-05HP is an ideal choice.

# TECHNICAL SUPPORT

## ZEOCHEM Technical Expertise

Throughout the decades supporting the industry, Zeochem has developed a vast know-how on adsorption processes. Zeochem's skilled technical team can provide a variety of solutions and technologies to meet process demands and maximize sieve performance and service life.



### These techniques include:

- Single layer dehydration/treating
- Multi layer dehydration/treating
- Pressure drop minimization
- COS minimization
- Dehydration with recycle of the regeneration gas
- Protection from liquids utilizing adsorbent guard layers
- Regeneration optimization procedure
- Multi column solutions with energy usage optimization
- Solutions based on lead lag technology
- Short cycle adsorbers for removal of high CO<sub>2</sub> concentrations

### *Bead vs. Pellet*

*Zeochem beads are round and smooth, strong and durable, exhibiting low dusting characteristics and potential breakage. One advantage of their spherical shape is that they are only under compressive forces, while extrusions (pellets) undergo compression as well as tension, making breakage more likely. In addition, the extrusion ends have angled edges making them subject to chipping and breakage.*

## Custom Designs and Unit Optimization

Zeochem's team of engineers utilizes proprietary simulation software coupled with customer feedback to evaluate each adsorption application to develop a unique solution. Product recommendations are based on feed compositions and conditions, adsorption performance requirements, and preexisting process limitations. This selection takes into account the polarity of contaminants and their order of adsorption.

For new units, these solutions include preliminary unit sizing and proposal of operational limitations. These simulations also provide recommended bed configuration, adsorption and regeneration cycle times, optimum sieve selection, regeneration requirements and overall vessel sizing.

For existing molecular sieve units, these simulations begin with a review of the current process design and feed composition and, where possible, include suggestions for operational changes to optimize performance. These evaluations are made with an emphasis on energy-efficient operations while maximizing the service life of the adsorbent.

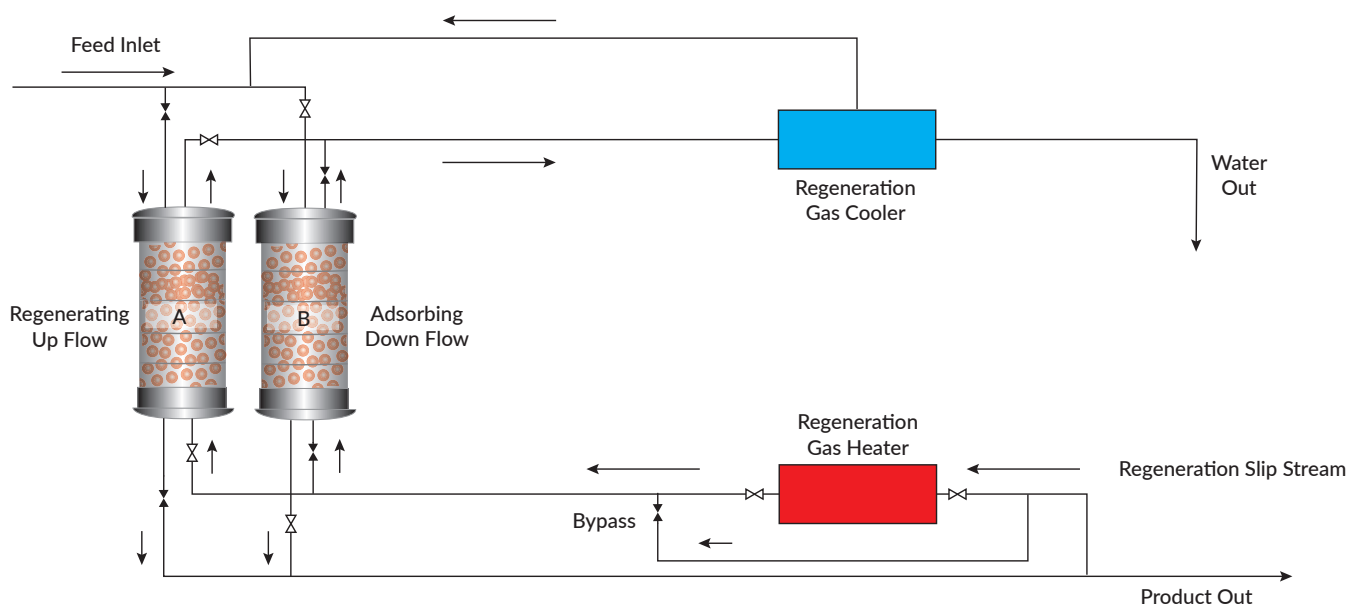
## Complete Bed Life Operational Support

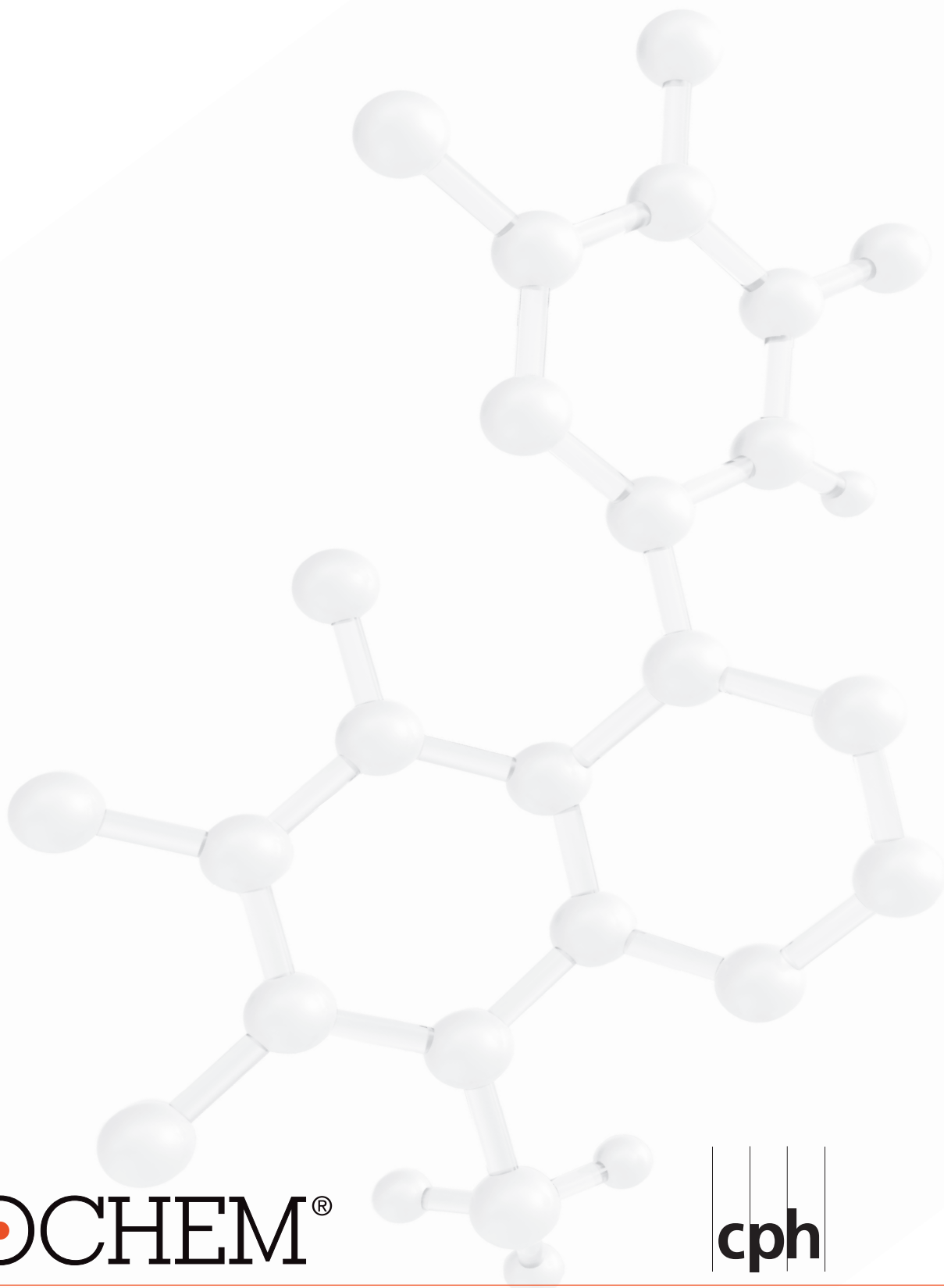
In addition to technical simulations and performance evaluations, we offer technical service and support for our molecular sieve adsorbents from start-of-run to end-of-run. We can provide on-site supervision for the loading of the material to ensure proper procedures are followed. Our team can also assist with startup of the unit once the loading is complete. During operation, should any concerns arise, our technical team can assist troubleshooting efforts via email, teleconference or on-site support. Our experienced personnel utilize plant data, performance testing and past experience to support optimization of operations and development of long-term solutions. Working with the simulation software and provided data, estimations can be made for remaining service life and recommendations shared for maximizing run time. When the sieve does reach end-of-run conditions, the Zeochem team can help supervise shutdown and unloading efforts. Following unloading, or even during shutdowns, samples from the plant may be sent to our technical team to test for aging effects and determination of remaining service life.

*Call us when you are ready to start your next project or to review the operations of your current unit prior to your next reload.*

*From the start of your project our technical service engineers can provide conceptual advice, product selection and design support. As the project moves forward, we do detailed designs and answer any questions regarding our products and their use in your operation. Our team provides training and startup assistance during commissioning. After-sale service is available for troubleshooting and performance optimization.*

### Gas Phase Flow Diagram





**ZEOCHEM<sup>®</sup>**

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