



HENGYE
hengyeinc.com

**3A Molecular Sieve
for
Ethanol Dehydration**



Table of Contents

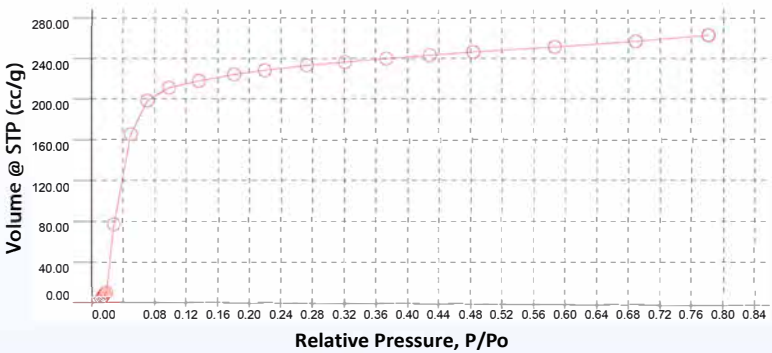
| | |
|---------------------------------|--------|
| Ethanol Dehydration Units | Page 1 |
| Isotherm | Page 2 |
| HYD03C 3A Molecular Sieve | Page 3 |
| Ethanol Plant Schematic | Page 4 |
| Inside Dehydration Unit | Page 5 |
| Mass Transfer Zone | Page 6 |
| Maintenance Tips | Page 7 |
| Why Choose Hengye Inc? | Page 8 |

Ethanol Dehydration Units

Through distillation alone, ethanol can only be dehydrated to around 95% to 97% purity. The last 3-5% of water is unable to be removed through distillation techniques due to the formation of an azeotrope, a point at which water no longer boils out of a solution. This remaining water has to be removed to allow ethanol to be used as fuel and in gasoline blending. To achieve fuel grade ethanol, molecular sieve, along with Pressure Swing Adsorption (PSA) technology, is applied and anhydrous ethanol can be achieved with ethanol purity around 99% pure or higher. 3A Molecular Sieve is capable of adsorbing water molecules, while allowing ethanol to pass through to the product stream.



Isotherm

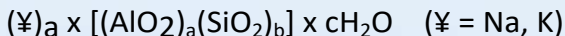


The moisture adsorption isotherm above shows the capacity of HYD03C Molecular Sieve at various operating pressures. Many Ethanol Plants operate Pressure Swing Adsorption dehydration units, which takes advantage of the fact that, as seen in the isotherm, as pressure increases, the molecular sieve's capacity for adsorbing water also increases. Higher temperatures, however, decreases a molecular sieve's adsorption capacity, so Ethanol Plants have to balance an ideal pressure and temperature to optimize the adsorption capacity within dehydration units. We have articles available on-line to guide operators to optimize operations and we are also available to discuss the subject at any time. We are just a phone call away.

HYD03C 3A Molecular Sieve

HYD03C is a molecular sieve that is specifically designed for Ethanol Dehydration Units and differs from standard molecular sieves by offering an advantageous balance of crush strength, adsorption capacity, and minimal co-adsorption properties. HYD03C has a superior selectivity between water and ethanol molecules, which increases both efficiency and dehydration capacity each cycle to help plants meet production goals and maximize output. This product is suitable for both pressure swing adsorption and temperature swing adsorption processes. Once ethanol has been dehydrated, it can then be applied in bio-fuels for direct blending and ETBE production, or for other uses such as in chemicals, food industry, pharmaceuticals, and more.

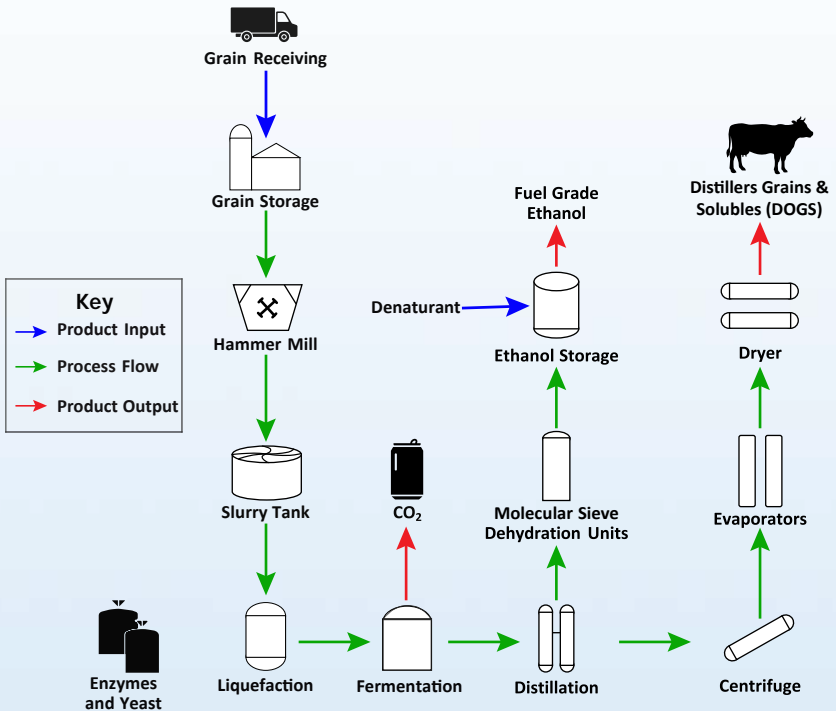
Chemical Formula



Specifications

| Molecular Sieve | | | | | |
|-------------------------|-------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| HYD03C | | Beads | | Pellets | |
| Property | Unit | 4x8 Mesh | 8x12 Mesh | 1/16 Inch | 1/8 Inch |
| Diameter | mm | 2.5 - 5.0 | 1.6 - 2.5 | 1.5 - 1.8 | 3.0 - 3.3 |
| Bulk Density | g/mL (lb/ft ³) | 0.70-0.76 (43.7-47.5) | 0.72-0.78 (44.9-48.7) | 0.68-0.74 (42.5-46.2) | 0.67-0.73 (41.8-45.6) |
| Crush Strength | N (lbm*ft/s ²) | ≥100 (≥22.4) | ≥40 (≥9) | ≥35 (≥7.9) | ≥70 (≥15.7) |
| Static Water Adsorption | wt% | ≥20.5 | ≥20.5 | ≥20.5 | ≥20.5 |
| Attrition | wt% | ≤0.1 | ≤0.1 | ≤0.4 | ≤0.4 |
| Moisture Content | wt% | ≤1.0 | ≤1.0 | ≤1.0 | ≤1.0 |
| Packaging Options | Beads | 150kg (330.7lb) / Drum | | | |
| | Pellets | 125kg (275.6lb) / Drum | | | |

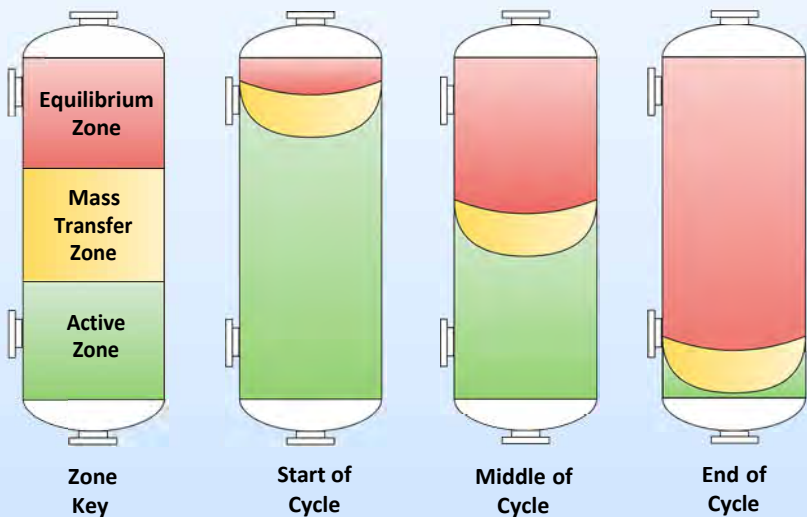
Ethanol Plant Schematic



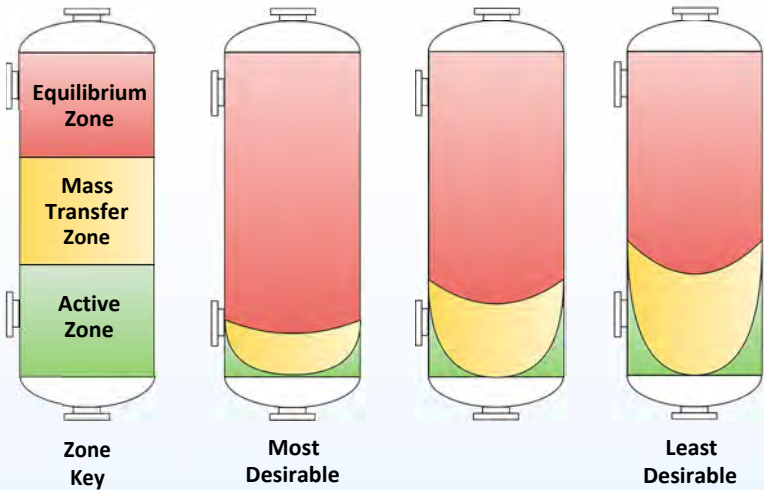
Aside from producing fuel grade ethanol, Ethanol Plants also produce CO₂ and distillers grain as operations are focused on efficiency and sustainability.

Inside a Dehydration Unit

The image below shows a single vessel at three different stages in the dehydration cycle. At the Start of Cycle, the majority of the bed is an Active Zone, where sieve is dry from regeneration and ready to adsorb water. The Mass Transfer Zone (MTZ), where sieve is actively adsorbing water, is beginning to move down the bed. At the Middle of Cycle, the MTZ has moved about half way down the bed. At the top of the bed, where ethanol and water enter the unit, water has fully saturated the sieve beads, this is known as the Equilibrium Zone. At the End of Cycle, the Mass Transfer Zone has made its way to the bottom of the bed and water will soon break through, so the cycle ends and the bed will be regenerated.



Mass Transfer Zone

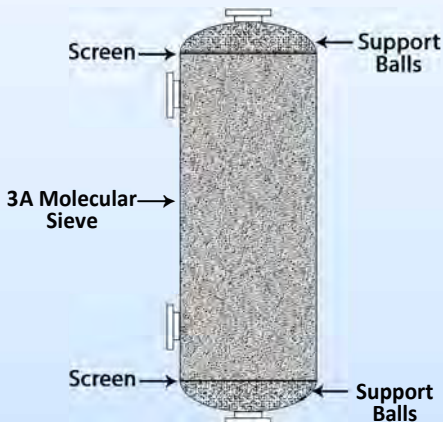


The image above shows three different vessels, each with different Mass Transfer Zone (MTZ) heights. The height of the MTZ plays an important role in overall bed capacity. The Most Desirable bed has the shortest Mass Transfer Zone and the largest Equilibrium Zone, meaning that this bed has adsorbed more water in one cycle than the other two. The Least Desirable bed, on the far right, has the tallest MTZ and smallest Equilibrium Zone, so this unit has adsorbed the least amount of water. It's important for operators to optimize the conditions within the dehydration unit and select a molecular sieve with an ideal Mass Transfer Rate to minimize the height of the Mass Transfer Zone and increase the overall capacity for water per cycle.

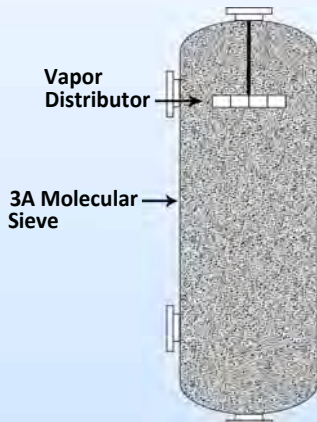
Maintenance Tips

While all ethanol plants are very different, some tips for maintenance resonate in every plant. The follow tips are simply tips to help protect the lifespan of your Molecular Sieve. Design and engineering teams should be consulted for actual operation guidelines.

- Be cautious of rapid pressure changes.
 - This can cause beads to break up and form dust.
- Follow a proper top-off schedule in Modern Layouts.
 - Excess space will cause beads to break up.
- Avoid contaminants such as cleaning chemicals.
 - This can damage, fuse, melt, or coke the beads.
- Maintain a proper temperature.
 - Too much or too little heat can damage beads.



Supported / Fix Bed



**Maximum Load
per Volume**

Why Choose Hengye Inc?

What We Offer You

- Molecular Sieve, Activated Alumina, Silica Gel
- ISO certified manufacturing, world class quality
- Ideal adsorption capacity and product durability

We Can Supply

- Reliable molecular sieve with proven success
- Inventory in Omaha, Nebraska and Houston, Texas
- Super sacks and drums available
- Sales, engineering, and technical service support
- Material analysis and capacity evaluation
- Change out, turnaround services

Support Services

- Remote and on-site support available
- Dehydration unit optimization and operation analysis
- Design engineering and bed loading calculations
- Systems training and activities support
- Material application education and product selection
- Change out services and commissioning
- Analyze remaining working life of products
- Breakthrough testing, product performance analysis

A Global Manufacturer

In 2014, Hengye[®] Inc. was established in the USA to meet the growing, dynamic adsorption needs in the American market. Our team provides a full range of services, including design work, bed sizing, technical support, optimization, turn around services, and more. Feed streams are unique and the superior design of Hengye products can meet the industry specifications required to maximize the value of product streams. Our engineers and technical advisors will provide the data and education to support and bring confidence to those who use Hengye products.



Hengye Inc.

11999 Katy Frwy, Ste 588
Houston, Texas 77079

toll free (844) 308-3271
facsimile (832) 288-4230
email info@hengyeinc.com

Connect with us...

