
HengYe
Celebrating 10 Years
Hydrogen
&
Renewable
Fuels
H_2
Hydrogen
H_2
hengyeinc.com

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Hydrogen Fuel

Hydrogen is remarked as the fuel of the future because of the clean environment it produces when being used and the many resources that it can be obtained from. Hydrogen can be produced from fossil fuels, biomass, and water electrolysis with wind, solar, or grid electricity. Hydrogen fuel can provide motive power for liquid-propellant rockets, cars, trucks, trains, boats and airplanes, portable fuel cell applications or stationary fuel cell applications, which can power an electric motor.

Hydrogen Purification

Hydrogen is remarked as the fuel of the future because of the clean environment it produces when being used and the many resources that it can be obtained from. Hydrogen can be produced from fossil fuels, biomass, and water electrolysis with wind, solar, or grid electricity. Hydrogen fuel can provide motive power for liquid-propellant rockets, cars, trucks, trains, boats and airplanes, portable fuel cell applications or stationary fuel cell applications, which can power an electric motor.

Hydrogen fuel is the most promising clean energy source in the near future and in order for it to be used in fuel cells it must meet certain purification levels that adsorbents can help achieve. Fuel cells can be used in a wide range of applications, including transportation, material handling and stationary, portable, and emergency backup power.

Hydrogen PSA Cycle

The heart of this purification system lies in the pressure swing cycles. During these cycles, the zeolite bed goes through two distinct phases: adsorption and desorption.

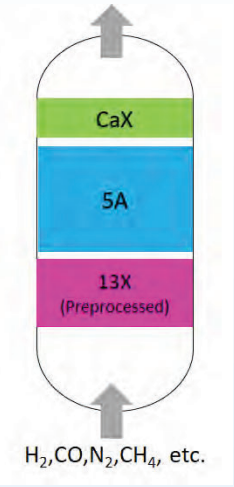
Adsorption Phase: In this phase, under high pressure, hydrogen is captured by the zeolite while other gases are allowed to pass through.
Desorption Phase: Next comes the desorption phase where the pressure inside the system is dropped. This causes the trapped hydrogen molecules to be released from the zeolite bed.
This alternate cycle of adsorption and desorption enables highly pure hydrogen to be separated from other gases present in the feed mixture.

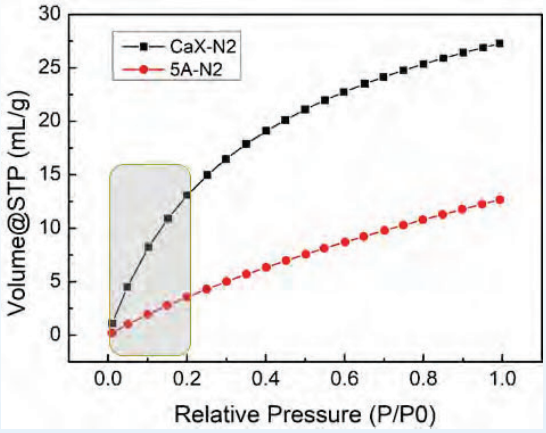
Like a sponge soaking up water and then being wrung out to release it, zeolite goes back and forth between capturing and releasing hydrogen during these pressure swing cycles.

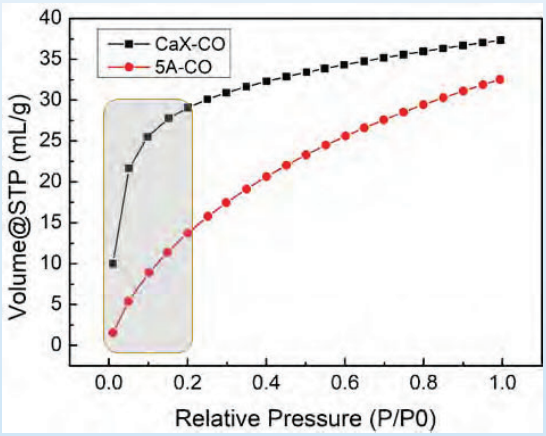
Think of these tailored zeolite solutions as specifically designed tools that ensure that every step of the PSA process is optimized for maximum performance, resulting in increased productivity and reduced operational costs for industries relying on industrial gas purification.

By understanding how PSA processes work alongside tailored zeolite solutions, we gain insight into just how crucial this breakthrough technology has become for industrial applications.

Hydrogen Product Design







Hydrogen Purification

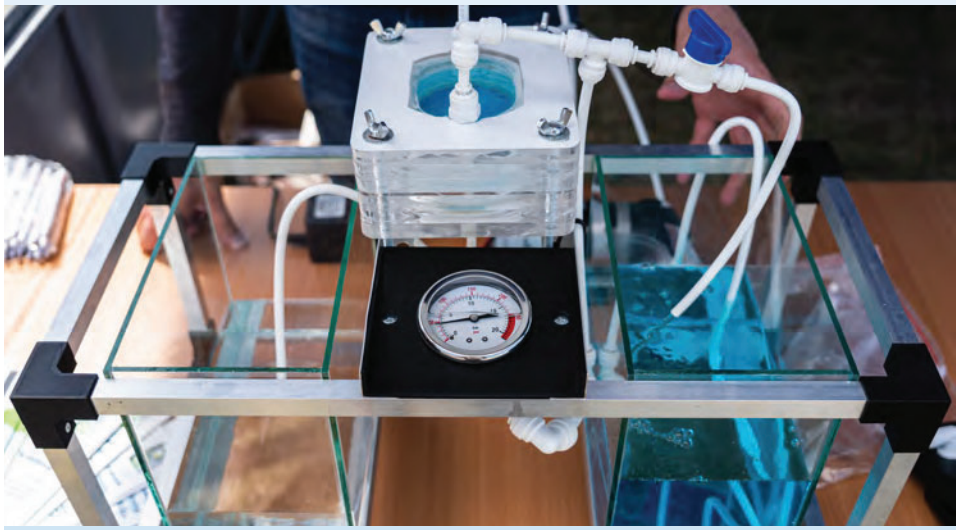
HYD10D Molecular Sieve

Molecular Sieve				
HYD10D		**Beads**		
Property	**Unit**	**4x8 Mesh**	**6x8 Mesh**	**8x12 Mesh**
Diameter	mm	2.36 - 4.76	2.36 - 3.35	1.68 - 2.36
Average Diameter	mm	3.8 - 4.1	2.9 - 3.1	1.9 - 2.1
Bulk Density	g/mL *(lb/ft^3)*	0.64-0.70 *(39.9-43.7)*	0.65-0.71 *(40.5 - 44.3)*	0.65-0.71 *(40.5-44.3)*
Crush Strength	N *(lbm*ft/s^2)*	≥60 *(≥13.4)*	≥45 *(≥10.1)*	≥25 *(≥5.6)*
Static Water Adsorption	wt%	≥28.0	≥28.0	≥28.0
Static CO_2 Adsorption	wt%	≥19.0	≥19.0	≥19.0
Attrition	wt%	≤0.1	≤0.1	≤0.1
Moisture Content	wt%	≤1.0	≤1.0	≤1.0
Packaging Options	1,000kg *(2,204.6lb)* / Super Sack; 140kg *(308.6lb)* / Drum			

Hydrogen Purification

HYGB500A Molecular Sieve

Molecular Sieve		
HYGB500A		**Beads**
Property	**Unit**	**8x12 Mesh**
Diameter	mm	1.6 - 2.5
Bulk Density	g/mL	0.76-0.80
Crush Strength	N	≥40
Static Water Adsorption	wt%	≥25.0
Static CO_2 Adsorption	wt%	≥17.5
Attrition	wt%	≥0.3
Moisture Content	wt%	≤1.0
Packaging Options	150kg *(330.7lb)* / Drum	



Hydrogen Purification

HYZ08G Molecular Sieve

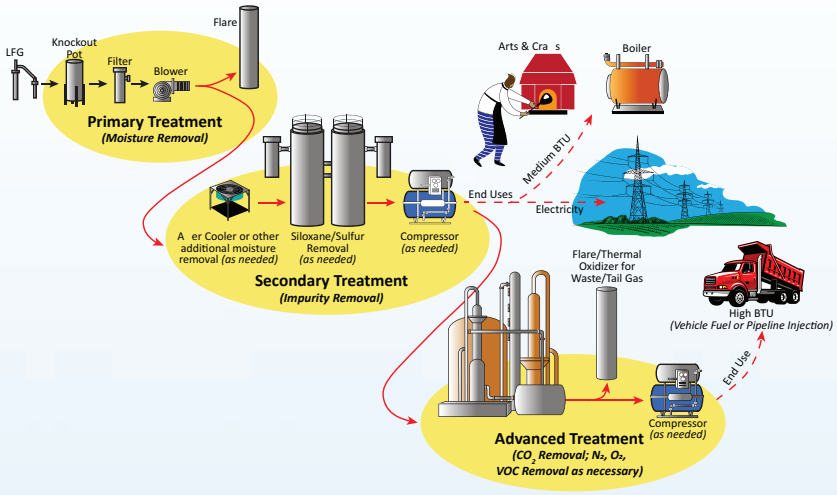
Molecular Sieve		
HYZ08G		**Beads**
Property	**Unit**	**8x12 Mesh**
Average Bead Size	mm	1.91 - 2.13
Tap Density	g/mL *(lb/ft³)*	0.63-0.70 *(39.3-43.7)*
Crush Strength	N *(lbm*ft/s²)*	≥21 *(≥4.7)*
Nitrogen Adsorption Capacity P/Pmax, 760 torr, 30˚C *(86˚F)*	wt%	≥34.9
CO_2 Adsorption Capacity 250 torr, 25˚C *(77˚F)*	wt%	≥20.5
KF at 575˚C *(1,067˚F)*	wt%	≤0.5
Attrition	wt%	≤0.5
Packaging Options	Super Sack options available; 140kg *(308.6lb)* / Drum	

Hydrogen Purification

HYAS200 Activated Alumina

Activated Alumina			
HYAS200		Beads	
Property	Unit	7x14 Mesh	4x8 Mesh
Particle Size	mm	1.0 - 3.0	2.0 - 5.0
Bulk Density	g/mL *(lb/ft^3)*	≥0.75 *(≥46.8)*	≥0.75 *(≥46.8)*
Crush Strength	N *(lbm*ft/s^2)*	≥45 *(≥10)*	≥160 *(≥36.0)*
Al_2O_3	wt%	≥92	≥92
Fe_2O_3	wt%	≤0.03	≤0.03
Loss on Ignition	wt%	≤6.0	≤6.0
Attrition	wt%	≤1.0	≤1.0
Packaging Options	Super Sack options available; 160kg *(352.7lb)* / Drum		

Landfill Gas



Landfill gas is a natural byproduct of the decomposition of organic material in landfills. This gas is composed of roughly 50% methane, 50% carbon dioxide, and a small amount of non-methane organic compounds. Landfill sites use various equipment and technology to treat this gas into achieving acceptable compositions of impurities for pipeline requirements. The treatment process of Landfill gas has three major stages:

1. Primary Treatment - Moisture Removal (H_2O removal)
2. Secondary Treatment - Impurity Removal (H_2S and Siloxane removal)
3. Advanced Treatment - Purity Achievement Based (CO_2, N_2, O_2, VOC removal)

H_2S Removal

Removal of H_2S is a critical procedure that helps reduce corrosion for power generation equipment, pre-treat LFG for high-BTU gas processing, and to reduce sulfur oxides (SO_x) emissions, associated with LFG combustion.

Applications for Desulfurization
(HYAS200 Activated Alumina)

This special adsorbent is a smooth, spherical adsorbent which has demonstrated its superior performance applied in the selectivity of removing COS, H_2S, CS_2 and any other mercaptans impurity from hydrocarbon streams.

Removes H_2S from following sources:

- Biogas that originates in sewage treatment plants due to anaerobic conditions in sludge
- Agricultural biogas
- Gases from anaerobic industrial sewage treatment facilities
- Landfill gas
- Industrial combustion and synthetic gases
- Waste and co-fermentation plant biogas after anaerobic digestion
- Miscellaneous H_2S containing industrial exhaust gas (i.e. paper industry, oil-mill applications)
- The treatment of H_2S containing exhaust from industries and wastewater treatment facilities

Specifications of HYAS200

(Activated Alumina for Desulfurization)

HYAS200 eliminates H2S and Mercaptans from landfilll gas and deactivates gradually from inlet to outlet through a packed bed, discarding behind a free-flowing, non-hazardous by-product. Typical H_2S Removal System units will have 2-3 vessels in place to achieve this removal process.

HYAS200 is a very porous form of aluminum oxide of high surface, typical chemical formula Al_2O_3 x nH_2O.

Activated Alumina			
HYAS200		Beads	
Property	Unit	7x14 Mesh	4x8 Mesh
Particle Size	mm	1.0 - 3.0	2.0 - 5.0
Bulk Density	g/mL *(lb/ft³)*	≥0.75 *(≥46.8)*	≥0.75 *(≥46.8)*
Crush Strength	N *(lbm*ft/s²)*	≥45 *(≥10)*	≥160 *(≥36.0)*
Al_2O_3	wt%	≥92	≥92
Fe_2O_3	wt%	≤0.03	≤0.03
Loss on Ignition	wt%	≤6.0	≤6.0
Attrition	wt%	≤1.0	≤1.0
Packaging Options	Super Sack options available; 160kg *(352.7lb)* / Drum		

Siloxane Removal

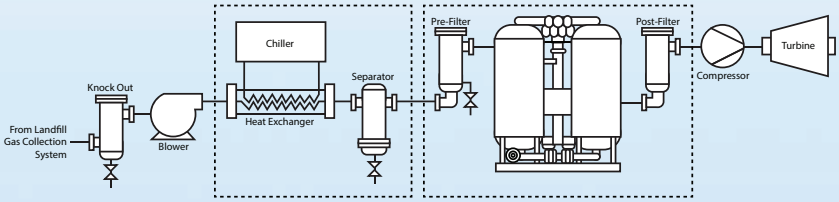
Removing siloxane is an important step in cleaning methane gases for use as fuel since siloxane is a form of crystalline silica that will essentially turn into glass when burned or combusted. The collection of combusted siloxanes inside of engine components can cause the buildup of heat, water, and other contaminants that can cause corrosion, leading to problems in the engine.

Molecular Sieve 13X Applications

HYD10A is manufactured to deeply dehydrate feed gas prior to cryogenic separation by removing water, carbon dioxide, and other contaminants from feed gas. The removal of these contaminants will allow the feed gas to be further separated into the desired product stream. This molecular sieve has an ideal selectivity for removing impurities that can freeze or block cryogenic separation processes.

- Used to deeply dehydrate feed gas
- Capable of removing water, carbon dioxide, hydrocarbons, and more
- Allows gas to be further separated or otherwise used in compressors
- Offers an advantageous adsorption capacity for a wide range of impurities

Siloxane Removal Schematic



Aside from removing siloxane due to impurity specification requirements it also serves as the solution for better machinery life-cycles and ensures longevity of end products from landfill gas plant.

Specifications of 13X

CHEMICAL FORMULA

(Ɏ)a x [(AlO_2)a(SiO_2)b] x $_cH_2O$ (Ɏ = Na)

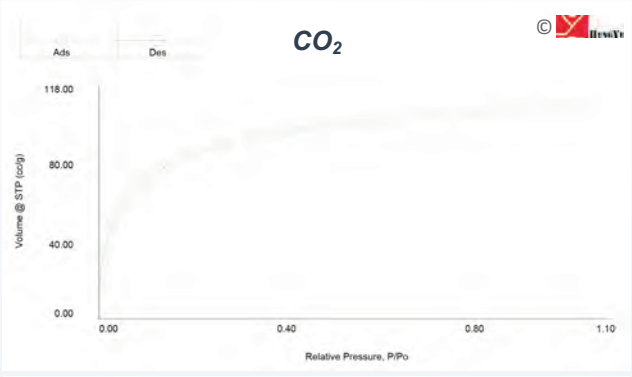
SPECIFICATIONS

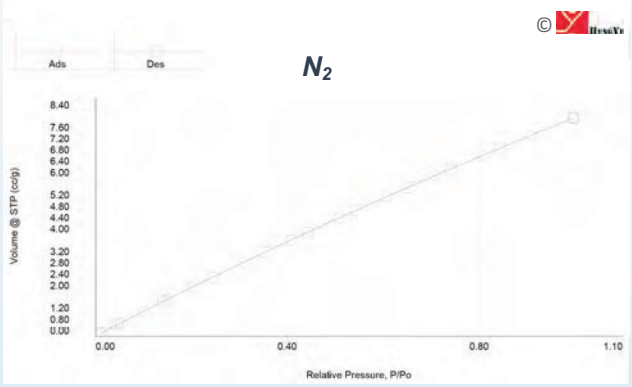
Molecular Sieve

HYD10A		Beads				Pellets	
Property	**Unit**	**4x8 Mesh**	**4x8 *Avg**	**8x12 Mesh**	**8x12 *Avg**	**1/16 Inch**	**1/8 Inch**
Diameter	mm	2.36 - 4.76	-	1.68 - 2.36	-	1.5 - 1.8	3.0 - 3.3
Bulk Density	g/mL *(lb/ft³)*	0.65-0.71 *(40.6-44.3)*	(40.90)	0.66 - 0.72 *(41.2-44.9)*	(40.90)	0.61 - 0.67 *(38.1-41.8)*	0.60 - 0.66 *(37.4-41.2)*
Crush Strength	N *(lbm*ft/s²)*	≥80 *(≥18)*	*(19.10)*	≥30 *(≥6.7)*	(19.10)	≥30 *(≥6.7)*	≥70 *(≥15.7)*
Static CO2Adsorption	wt%	≥17.5	28.34	≥17.5	28.34	≥16.5	≥16.5
Attrition	wt%	≤0.1	0.07	≤0.1	0.07	≤0.4	≤0.4
Moisture Content	wt%	≤1.5	0.45	≤1.5	0.45	≤1.5	≤1.5
Packaging Options	Beads Pellets	1,000kg *(2,204.6lb)* / Super Sack; 140kg *(308.6lb)* / Drum 1,000kg *(2,204.6lb)* / Super Sack; 125kg *(275.6lb)* / Drum					

**Avg* refers to a running average of lot analyses

13X Isotherm Data





These charts indicate that HYD10A shows high N_2, and CO_2 separation under a very low pressure, which lowers the consumption of oxygen during generation and improves economic performance. HYD10A molecular sieve is most commonly used to remove contaminants such as water, carbon dioxide, and hydrocarbons from feed gas in air pre-purification units prior to cryogenic air separation. This molecular sieve will also remove hydrogen sulfide, mercaptans, and high molecular weight sulfur compounds in LNG, LPG, and liquid hydrocarbon streams, such as propane and butane.

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®

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