Adsorbents for Petrochemical Purification
Trust BASF Adsorbents for Petrochemical Purification

For over 50 years, BASF has been a leading supplier of adsorbents to a wide-range of industries. We help companies to meet and exceed demanding quality, environmental and government standards with solutions tailored to companies’ specific needs. At BASF, we do this by thinking differently. We control all aspects of product development from design to packaging and quality control. We provide customized products to meet specific production requirements. We offer highly reliable technical service that incorporates the skills, expertise, and knowhow found throughout BASF.

BASF broad petrochemical purification product range offers:

- Highly effective removal of a wide range of contaminants from olefin-containing streams
- Complete system solutions for treatment of off-gas streams from catalytic crackers (FCC, DCC, CPP) and acetylene producing units
- Long lifetime and easy operability
- Physical hardness and durability
- Outstanding global technical support and distribution

Petrochemical Purification Products from BASF:

- Selexsorb® Activated Aluminas
- PuriStar® and ProSorb® Metal Oxide-based Products
The BASF Difference

At BASF, we make adsorbents differently. The difference comes from not only making our adsorbents differently, it comes from thinking differently.

BASF leads the way in helping businesses and institutions across industries meet and exceed stringent moisture control standards with a variety of superior and unique alumina, desiccant and adsorbent technologies that underscore BASF’s reputation for delivering ingenious answers to tough business challenges. It is this distinction that sets us apart. Customers seek us out in the marketplace for their market control and purification requirements. We make adsorbents differently.

Not your traditional silica gel... Sorbead® Adsorbents

Not just to be different... proprietary ball forming manufacturing process

Our Sorbead* alumino-silica gels are manufactured in a special sol-gel process that leads to very unique properties. Unique in terms of low abrasion, high crush strength and — most important — high adsorption capacity. Furthermore, the unique manufacturing process enables BASF to adjust the pore size to the specific application.

* In Europe, Sorbead adsorbents are also known by the registered trade name KC-Trockenperlen®
Effects of Impurities (COS) on Polymerization Activity

- Effects of Impurities (COS) on Polymerization Activity

**Petrochemical Purification Fields of Applications**

1. Fluid catalytic cracking (FCC unit)
2. FCC offgas recovery unit
   - Cracked gas purification
   - Thermal cracking unit (furnaces)
3. Propylene recovery (separation unit)
4. Propylene purification unit
5. Ethylene oxide (EO) plants
6. Butanol plants
7. Cumene plants
8. Polypropylene (PP) plants
9. Polyethylene (PE) plants
10. Olive oil

**Diagram Description**

- Transfer of impurities from the FCC unit to the propylene recovery and purification units.
- Impurities are further refined through selective hydrogenation units (C2 SHU, C3 SHU, C4 SHU, C5+ SHU).
- Activity [%] of different types of catalysts (Ziegler-Natta 1st-4th Generation, Metallocene) is shown in relation to COS content.

**Source**

- Former BASF PP research

**Graph**

- Y-axis: Activity [%] (relating to active components)
- X-axis: Type of catalyst
- COS content markers: < 20 ppb, 30 ppb, 100 ppb, 500 ppb
PuriStar® and Prosorb® Metal Oxide Based Products

PuriStar and Prosorb use selective chemical reactions to remove a wide range of contaminants. Combinations of PuriStar, Prosorb, Selexsorb and other BASF adsorbents can provide complete, engineered solutions to purification or contaminant issues.

Contaminants Removed:
- Arsine
- Phosphine
- H₂S and COS
- Oxygen
- Hydrogen
- CO
- Trace levels of Acetylenes and Dienes
- CS₂

Contaminants Removed:
- COS, H₂S, CS₂
- CO₂, H₂O, NH₃
- Mercaptans
- Sulfides, Disulfides
- Thiophenes
- Oxygenates (Alcohols, Aldehyde, Ketones, etc.)
- Amines, Amides, Nitriles
- Organosilicates
- Arsine

Purification of Feedstocks for Processes Producing:
- Polyethylene
- Polypropylene
- Cumene
- Ethyl Benzene/Styrene/Monomer
- Many others

Purification of Feedstocks for Processes Producing:
- Olefins (Ethylene, Propylene, Butenes, etc.)
- Aliphatics (Propane, Butane, etc.)
- Gases (Air, CO₂, Hydrogen, Nitrogen, Natural Gas, etc.)
- Feedstocks for Alkylation units and units producing MTBE and TAME
- Feedstocks for BTX units

Selexsorb® Activated Alumina Products

Selexsorb, a select group of promoted state-of-the-art alumina adsorbents, is used in various aspects of olefin production and refining. Selexsorb can be used alone or in combination with PuriStar metal oxide products. Most of the Selexsorb adsorbents can also be regenerated at higher temperature. This regeneration step allows use of the adsorbent for numerous cycles.

Contaminants Removed:
- COS, H₂S, CS₂
- CO₂, H₂O, NH₃
- Mercaptans
- Sulfides, Disulfides
- Thiophenes
- Oxygenates (Alcohols, Aldehyde, Ketones, etc.)
- Amines, Amides, Nitriles
- Organosilicates
- Arsine

Purification of:
- Olefins (Ethylene, Propylene, Butenes, etc.)
- Aliphatics (Propane, Butane, etc.)
- Gases (Air, CO₂, Hydrogen, Nitrogen, Natural Gas, etc.)
- Feedstocks for Alkylation units and units producing MTBE and TAME
- Feedstocks for BTX units

Contaminants Removed:
- CS₂
- Polyethylene
- Polypropylene
- Cumene
- Ethyl Benzene/Styrene/Monomer
- Many others

Purification of:
- Olefins (Ethylene, Propylene, Butenes, etc.)
- Aliphatics (Propane, Butane, etc.)
- Gases (Air, CO₂, Hydrogen, Nitrogen, Natural Gas, etc.)
- Feedstocks for BTX units
### Selexsorb® Products at a Glance

<table>
<thead>
<tr>
<th>Adsorbent</th>
<th>Shape</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selexsorb AS</td>
<td>Sphere</td>
<td>Arsine, phosphine, H₂S and COS removal from propylene</td>
</tr>
<tr>
<td>Selexsorb CD</td>
<td>Sphere</td>
<td>Alcohols, aldehydes, ketones, ethers and various carboxylic acids removal from liquid hydrocarbon feed streams</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Removal of oxygenates, mercaptans, sulfides and disulfides from C₄ raffinate streams</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water and trace contaminants removal from carbon dioxide; carboxylic acids removal from liquid hydrocarbon feed streams</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oxygenated organic compound removal from feed monomer, feed comonomer and recycle solvent streams in polymer production processes</td>
</tr>
<tr>
<td>Selexsorb CDL</td>
<td>Sphere</td>
<td>Removal of oxygenates, nitrogen and sulfur containing compounds from olefinic streams with enhanced performance</td>
</tr>
<tr>
<td>Selexsorb CDO</td>
<td>Sphere</td>
<td>Oxygenated compounds and other Lewis bases removal from streams with Brønsted acidity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oxygenates removal from C₄ raffinate stream</td>
</tr>
<tr>
<td>Selexsorb CDX</td>
<td>Sphere</td>
<td>Nitrogen and sulfur-based organic contaminants removal from isobutylene and isoamylene feedstreams to these etherification processes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oxygenates removal from C₄ raffinate stream from MTBE and C₅ raffinate stream from tetra amine methyl ester (TAME)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nitrogen, sulfur, and oxygen-based organic contaminants removal from liquid hydrocarbon feed streams to catalytic processes such as dehydrogenation, hydrogenation and isomerization</td>
</tr>
<tr>
<td>Selexsorb COS</td>
<td>Sphere</td>
<td>COS, CO₂, H₂S and CS₂ removal from hydrocarbon streams and industrial gases</td>
</tr>
<tr>
<td>Selexsorb SG</td>
<td>Sphere</td>
<td>Removal of disulfides and thiophenes from gas and liquid streams</td>
</tr>
</tbody>
</table>
### PuriStar® and Prosorb® Products at a Glance

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Components</th>
<th>Shape</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>PuriStar R0-20</td>
<td>Pd</td>
<td>Sphere</td>
<td>Catalytic oxygen removal from inert gases and H₂</td>
</tr>
<tr>
<td>PuriStar R3-11,</td>
<td>CuO</td>
<td>Tablet</td>
<td>Regenerative removal of O₂, CO, H₂ and other industrial gases and liquids</td>
</tr>
<tr>
<td>PuriStar R3-11 G</td>
<td></td>
<td>Tablet</td>
<td></td>
</tr>
<tr>
<td>PuriStar R3-12</td>
<td>CuO, ZnO</td>
<td>Tablet</td>
<td>Removal of traces of arsine, phosphine, COS, H₂S and other reactive compounds from hydrocarbons in vapor or liquid phase</td>
</tr>
<tr>
<td>PuriStar R3-15</td>
<td>CuO, ZnO</td>
<td>Tablet</td>
<td>Adsorptive removal of O₂, CO, H₂ and other industrial gases and liquids</td>
</tr>
<tr>
<td>PuriStar R3-16</td>
<td>CuO, ZnO</td>
<td>Tablet</td>
<td>Catalytic removal of O₂, CO, H₂, sulfur compounds and others from ethylene</td>
</tr>
<tr>
<td>PuriStar R3-17</td>
<td>CuO</td>
<td>Tablet</td>
<td>Removal of CO from liquid propylene streams at ambient temperatures</td>
</tr>
<tr>
<td>PuriStar R3-81</td>
<td>CuO</td>
<td>Tablet</td>
<td>Removal of O₂, NOx and others in refinery off-gases for the recovery of ethylene and propylene</td>
</tr>
<tr>
<td>PuriStar R8-21</td>
<td>NiO, MoO₃</td>
<td>Extrudate</td>
<td>Removal of O₂, NOx and others in refinery off-gases for the recovery of ethylene and propylene</td>
</tr>
<tr>
<td>PuriStar R9-12,</td>
<td>PbO</td>
<td>Extrudate/Sphere</td>
<td>Removal of arsine from hydrogen rich cracked gases</td>
</tr>
<tr>
<td>E-315</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prosorb</td>
<td>Ni, NiO</td>
<td>Extrudate</td>
<td>Removal of traces of arsine, phosphine, sulfur compounds, O₂, CO, CO₂ and hydrogen</td>
</tr>
</tbody>
</table>
BASF Adsorbents at Work in the Purification Industry

Petrochemical Purification
Integrated Portfolio for Ethylene

The diagram shown addresses typical contaminants found in ethylene, while trying to minimize investment and operating costs. To achieve this, BASF offers state-of-the-art products and advanced processes. Depending on the contaminants present, the scheme can be adapted or changed.
BASF offers the broadest portfolio of materials in the market to treat propylene. At the same time, the right combination of these materials allows the removal of wide ranges of contaminants from high ppm levels down to low ppb values. Our vast expertise with all of these materials allows us to provide the best solution possible.

**Petrochemical Purification**

**Integrated Portfolio for Propylene**

<table>
<thead>
<tr>
<th>Propylene</th>
<th>Removal of</th>
<th>Propylene</th>
<th>Removal of</th>
<th>Propylene</th>
<th>Removal of</th>
<th>Propylene</th>
<th>Removal of</th>
<th>Propylene</th>
<th>Removal of</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂S</td>
<td></td>
<td>COS</td>
<td></td>
<td>Mercaptans*</td>
<td></td>
<td>H₂S</td>
<td></td>
<td>Arsine</td>
<td></td>
</tr>
<tr>
<td>COS</td>
<td></td>
<td>Oxygénates</td>
<td></td>
<td>NH₃</td>
<td></td>
<td>COS</td>
<td></td>
<td>Phosphine</td>
<td></td>
</tr>
<tr>
<td>Mercaptans*</td>
<td></td>
<td>H₂S</td>
<td></td>
<td>Mercaptans*</td>
<td></td>
<td></td>
<td></td>
<td>CO</td>
<td></td>
</tr>
<tr>
<td>Nitriles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CO₂</td>
<td></td>
</tr>
</tbody>
</table>

* Partial removal
This combination of products allows treatment of a wide range of contaminants, while maximizing the recovery of olefins. This provides superior economics for the user. A dedicated R&D facility allows BASF to tailor the solution to individual conditions.
Service

BASF’s state-of-the-art Petrochemical Purification products are backed by the best technical support in the industry. Technical service for adsorbent application, design, optimization of the purification process and regeneration, and troubleshooting are available in our global markets. BASF understands that support and service are paramount for achieving customer success. Both technical service and adsorbent development are supported by BASF laboratories. We are dedicated to offering intelligent system solutions that work together with our outstanding customer and technical support.

Service Attributes

Outstanding BASF Technical Support Continues After Delivery

- Technical seminars on product usage and optimization
- Plant troubleshooting, via phone, email, or plant visit
- Recommendations and assistance for optimizing plant performance with appropriate loading and commissioning techniques

Visit our website at www.catalysts.basf.com/adsorbents for more information.
About Us

BASF's Catalysts division is the world's leading supplier of environmental and process catalysts. The group offers exceptional expertise in the development of technologies that protect the air we breathe, produce the fuels that power our world and ensure efficient production of a wide variety of chemicals, plastics and other products, including advanced battery materials. By leveraging our industry-leading R&D platforms, passion for innovation and deep knowledge of precious and base metals, BASF's Catalysts division develops unique, proprietary solutions that drive customer success.

BASF - We create chemistry

aMDEA, Prosorb, PurStar, Selexsorb, Sorbead and KC-Trockenperlen are trademarks of BASF.

Although all statements and information in this publication are believed to be accurate and reliable, they are presented gratis and for guidance only, and risks and liability for results obtained by use of the products or application of the suggestions described are assumed by the user. NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH. Statements or suggestions concerning possible use of the products are made without representation or warranty that any such use is free of patent infringement and are not recommendations to infringe any patent. The user should not assume that toxicity data and safety measures are indicated or that other measures may not be required. © 2015 BASF

www.catalysts.basf.com/adsorbents