DARAACLAR®
Beer Stabilisers
World Standard for Performance

W.R. Grace & Co.-Conn., is a global leader in the production of silica products, molecular sieves, fluid cracking catalysts, specialty catalysts, can and closure coatings and sealants.

With manufacturing sites, research and development centers and sales offices worldwide, Grace maintains a leading position as a world class supplier of high technology specialty chemicals and operates in more than 100 countries.

All of our global operations are committed to a Quality Management System and have ISO 9001. In addition Worms and Düren have ISO 14001 accreditation. This certification reinforces the fact that all aspects of our organisation are striving to continuously provide the highest quality products and standards of service to our customers.

When it comes to product quality, technical assistance, customer support, global operations and timely delivery, Grace makes a world of difference!

Micronised Silicas

Redefining Quality – World Class Manufacturing
Synthetic silica is produced during the reaction of sodium silicate (water glass) and sulphuric acid. Upon mixing, these two base ingredients undergo a polymerisation process resulting in the formation of silicic acid, the proto silica gel. Following this, the process goes through various phases of ageing, purification and milling before the final product is packaged and ready for delivery.

Grace is operating according to the HACCP concept and towards IPEC GMP.

Schematic of the micronised silica gel production process
Schematic of a Silica Gel Particle

The porosity of the particle is essentially a combination of all the microscopic inter-connecting channels, particles being of varying dimensions.

Purity, Properties and Parameters

Purity and Morphology
At the end of the production process the micronised particles of silicon dioxide (silica gel) have a high purity. The high levels of chemical purity and amorphous nature ensures that DARACLAR® silicas are safe to use.

Particle and Porosity
From a performance perspective, two major parameters characterise the DARACLAR® silica (illustrated in the schematic below). These parameters are:

- Average particle size (APS): a controlled APS and narrow particle size distribution range ensures highly effective filtration performance
- Pore volume (PV): a controlled PV imparts to DARACLAR® silica its unique efficiency in adsorbing haze-forming proteins

The DARACLAR® Silica Advantage

The Art of the Brew Master
Dating as far back as Phoenician times, the brewing of beer has been a delicate balance of art and science. Through the centuries, the process of distilling this hearty libation from various grains and hops has attained a level of perfection and is considered by many today to be as basic to modern culture as bread.

To achieve a distinctive beer, the brew master must carefully monitor, control and influence every phase of the brewing process. Ultimately, the quality of a beer is judged by its flavour, clarity, colour and foam retention.

One of the most critical phases in the brewing process is chill-proofing. To ensure the clarity of beer, the brew master must add a stabiliser to eliminate proteins which may cloud the beer. In the 1960’s, brew masters developed a stabilisation process using silica. To this day Grace’s DARACLAR® silica products remain one of the most efficient methods for chill-proofing.

Grace was instrumental in the development of a selective adsorbent for beer stabilisation. In 1964 Emil Eichhorn of Grace, along with Dr. Karl Raible of the Gaerungstechnik in Germany, presented the results of years of research with silica gel as a beer stabiliser in their article “Development of a Selective Adsorbent (Silica Gel) for Beer Stabilisation”. Since that time, Grace has remained a leading supplier of silica gel stabilisers to the global beer industry.
Mechanism of Chill-Haze

The brilliance of filtered beer is an important factor influencing consumer acceptance. The presence of haze in beer is usually associated with inferior quality.

Haze in beer is, however, a natural phenomenon and proper treatment is required to prevent or delay its formation. Upon storage for several days, beer develops a cloudiness, which is only observable at about 0°C, and which completely redissolves if the temperature of the beer rises. This type of haze is called “chill-haze” and the process for its prevention are referred to as “chillproofing”.

Chill-proofing can be achieved by the selective removal of haze-sensitive proteins. DARACLAR® stabilising agents are synthetic silica gels of high purity and consistent quality, which selectively remove proteins that participate in chill-haze and NOT those responsible for beer foam or mouthfeel. DARACLAR® silica is a highly selective adsorbent developed specifically for the brewing process.

DARACLAR® silica requires only a short period of time to work, and does not affect the flavor, clarity, color or foam of beer. In some cases, it may even eliminate the need for foam stabilisers.

Because of the low density, DARACLAR® stabilisers, when slurried, remain longer in the beer suspension, and therefore do not require continuous agitation.

DARACLAR® silica is a synthetic amorphous silica adsorbent produced from pure raw materials. It is chemically inert and insoluble in beer. It is therefore easily and completely removed during the filtration process.
Demonstrating the Effectiveness of DARACLAR® Beer Stabilisers

DARACLAR® beer stabilisers are highly efficient, fast-acting adsorbents. Because of their particle size distribution and surface structure, they rapidly adsorb the substances responsible for haze formation.

Depending on the colloidal nature of the beer, it is also possible that polyphenols, in the form of protein-polyphenol complexes, will be removed.

The quality of the beer is significantly improved by the use of DARACLAR® silica gels.

**Figure 1** demonstrates the high affinity of DARACLAR® silica for high molecular weight proteins.

**Figure 2** shows the improvement in colloidal stability after treatment with DARACLAR® silica.

**Figure 3** shows the improvement in colloidal stability after treatment with DARACLAR® silica in combination with PVPP.

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**DARACLAR® SILICA CLEARLY THE BEST**
# DARACLAR® Silicas: The Stabiliser of Choice

In consideration of many different protein based adsorption requirements, Grace offers a wide range of highly activated tailormade xero-, hydrous- and hydrogel grades.

<table>
<thead>
<tr>
<th>Physical and Chemical Properties</th>
<th>DARACLAR® Hydrogel</th>
<th>DARACLAR® Hydrous Gel</th>
<th>DARACLAR® Xerogel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>White odorless powder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical structure</td>
<td>Amorphous silica gel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical composition</td>
<td>Pure hydrated silicon dioxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss on drying (%)</td>
<td>ø 63</td>
<td>ø 40</td>
<td>ø 2</td>
</tr>
<tr>
<td>Average particle size (µm)</td>
<td>19</td>
<td>19</td>
<td>Tailor-made</td>
</tr>
<tr>
<td>(Malvern Mastersizer)</td>
<td></td>
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</tbody>
</table>

**Law**

Meets the requirements of the “German Purity Law”, FDA and others

**DARACLAR® beer stabilisers are physiologically inactive.**
Easy Addition into the Process

DARACLAR® beer stabilisers are added directly to the unfiltered beer. The simplest technique is to add DARACLAR® silica in the filtration stage together with the Kieselguhr in the bodyfeed. The quantity required depends on the colloidal beer stability but usually ranges between 10 and 100 grams per hectolitre beer. DARACLAR® beer stabilisers can be integrated into all traditional beer stabilising processes.

Inline Addition of DARACLAR® Silica Prior to Storage/Maturation – Tank Stabilisation

Addition of DARACLAR® Silica at the Kieselguhr Filtration Step
Addition of DARACLAR® Silica to the Buffer Tank Prior to Filtration

Addition of DARACLAR® Silica in Combination with Recycled PVPP

DARACLAR® Silica in Combination with One-way PVPP
Packaging Products for the Beer and Beverage Industry

In addition to our silica and molecular sieve products we also provide packaging products such as sealants and coatings for cans and closures to ensure the integrity and stability of food, beverage and consumer goods.

Closure Systems
Grace is the world’s premier supplier of Sealants, Coatings and Additives, marketed under the DAREX®, APPERTA®, Celox®, Sincera® and Sistiaga® tradenames to the closure industry.

- Sealants suitable for all closure styles including metal crown and beverage closures, plastic closures and large diameter closures
- PVC and PVC-free technologies
- Celox® active scavenging technologies reduce the oxygen content and ingress in the package. Thus, the level of oxidation is significantly reduced which is your protection against any stale taste occurring within your premium brand beverages.
- Sincera® taste-free removal torque reduction solutions
- State-of-the-art Coatings ranging from internal adhesion lacquers and primers to external crown, large diameter and ROPP overprint varnishes and protection lacquers.

Can Products
As the global technology leader, we understand it’s what you don’t see in your can sealants and coatings that count.

- Water based and environmentally friendly solvent based sealant technologies for high speed, high volume as well as low speed, smaller volume applications.
- Sealants for all segments: Aerosol, Beer & Beverage, Composite, Food and General Line
- High performance food can coatings featuring excellent pack resistance and formability

Global Scope
Research & Development, Technical Customer Service (TCS)

Grace is a firm believer in innovation. Our R&D group, staffed by a team of research scientists, continually strives to improve the quality of our products.

We seek ways to broaden our product portfolio, so as to accommodate the increasing wants and needs of our customers.

We have in place a Global TCS group, consisting of experienced professionals and brew masters, who support our worldwide beer business. The team is dedicated to develop technical partnerships with our customers in the effective use of DARACLAR® beer stabilisers.

Our main support activities include: customer interaction and consultation through site visits, video-conferencing and other forms of telecommunication. TCS projectwork involving our application development laboratories conducts investigative work in co-operation with, or on behalf of, our customers.

The TCS group, while centrally managed, is regionally based, providing both local know-how and global support. The Technical Centers of Excellence are situated in the following locations:

- USA – Baltimore, MD, supporting North America
- Germany – Worms, supporting Europe, Asia Pacific, Middle East and Africa
- Brazil – Sorocaba, supporting Latin America

No matter where in the world you are located, you can always rely on the same high standard of service and support. This we believe is fundamental to develop successful partnerships the world over.

Packaging

We offer a wide range of flexible packaging options for our DARACLAR® products, including:

- Specialised multilayer palletised valve bags
- Customised big bag options
- Silo trucks for bulk deliveries

The prompt delivery of DARACLAR® beer stabilisers is assured through our global production facilities.

FDA Statement, Safety Issues

Safety is a priority at Grace. DARACLAR® beer stabilisers are approved by a variety of international authorities like the FDA (for indirect food contact) and the Scientific Committee of Food. For further information our EH&S department will be willing to offer assistance.

Quality Management

Our Quality Management System takes a customer-centric approach and is based on Grace’s philosophy of continuous improvement in every area of the organisation.

- All our facilities are ISO 9001 and 14001 certified and we implement internal and external audits to find ways to improve our services and processes.
- We employ Statistical Process Controls (SPC) to monitor and analyse production and related work processes.
- Our well-equipped Quality Control department works around the clock to ensure constant product quality.
- We continuously collect and assess customer information and feedback as an important factor in our Quality Management System.

In order to meet the needs and expectations of our customers, the Quality Management program includes the functional divisions of marketing, research and development as well as customer service. Our dedicated work force is an important asset and customer satisfaction is our most important objective.

The Six Sigma® Advantage

At Grace, we are committed to a Quality Management System, including the continuous improvement of our processes. To maintain Grace’s high standards, we employ Grace’s Six Sigma® tools. These were designed to investigate process parameters, quantify their effects and optimise these in order to achieve the best possible results. Our Six Sigma® initiative aims at improving both product consistency as well as production flexibility using advanced statistical methods and evaluation procedures. Our customers benefit from products of the highest quality.
Grace is a premier specialty chemical and materials company with more than 6000 employees located around the world. Our products are used by millions of people each day. Among many other things, we ensure the integrity of some of the world’s major buildings and bridges, enhance the performance of your petroleum products and preserve the safety of your food.

Grace has successfully pre-registered all REACH relevant substances. The next step is the ongoing preparation of the required registration dossiers and final registration of our substances. Grace has already fully registered its synthetic amorphous silica. Now our customers can have confidence in REACH compliance and supply security beyond 2010.

Non-EU customers should contact us about their import needs.

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