SYLODENT® / SYLOBLANC®
Cleaning and Thickening Silica Agents for Toothpaste

Grace Davison
Materials & Packaging Technologies
Product Range

SYLODENT®/SYLOBLANC®
Cleaning and Thickening Silica Agents for Toothpaste Industry

DARACLAR®
Beer Stabilizers

CRYOSIV®
Desiccant for Refrigerant Drying

PHONOSORB®
Beaded Adsorbents for Insulating Glass

SAFETYSORB®
Desiccants for the Pharmaceutical and Diagnostic Applications

SYLOSIV®
Molecular Sieve Powder for the Polyurethane Industry

SYLOID®
Matting Agents for Coatings

SHIELDEX®
Non-toxic Anti-corrosion Pigments

SYLOJET®
Pigments for Ink Jet Coatings

TRISYL®
Silica Gel for Refining Edible Oil

LUDOX®
Colloidal Silica

SYLOWHITE™
Titanium Dioxide Extenders for Paints and Printing Inks

PERKASIL®
Reinforcing Agents for the Tire and Rubber Industry

DURAFILL®
Special Pigments and Fillers for the Paper and Pulp Industry

APPERTA®
Can Coatings

DAREX®
Can and Closure Sealants

SISTIAGA®
Can Coatings

CELOX®
Oxygen Scavengers

SINCERA®
Closure Sealants
The Company

Grace Davison, a business division of W. R. Grace & Co., is a specialty chemical and materials company with a special focus on silica and silica-based chemistry and technology, with more than 150 years of experience.

We are noted for our experienced people, global reach and strong customer relationships.

Our specialty silica and silica-based materials improve product performance or enhance manufacturing processes in a wide range of industrial and consumer applications.

Our key strengths are the following:
- Ability to innovate products and processes
- Manufacturing flexibility and speed
- Agile supply chain organization
- Global infrastructure
- Deep knowledge of our customers’ processes
- Highly qualified Technical Customer Service (TCS) Group

Safety First

At Grace Davison, our first priority is to ensure the safety of all those who work with us or come in contact with our products.

No matter where your business is located, one thing stays the same – Our Commitment

Protecting the environment is our major focus, and we are proud to maintain an outstanding record of leadership in safety standards and good corporate citizenship.

Through the Responsible Care® program, every Grace Davison facility worldwide fulfills both stringent health and safety requirements as well as environmental requirements.
Grace: A Toothpaste Story
Lasting More Than 40 Years

Today the use of silica in toothpaste is a consolidated practice making possible the use of active ingredients such as sodium fluoride. Probably few of us know where and when it started. The trigger that ignited the use of silica can be dated back to 1967, when use of a xerogel silica grade named SYLOID® 63 silica was recognized and patented by The Lever Bros. Company.

That specific Grace silica grade was used for formulating CLOSE-UP® the first transparent toothpaste. This event marked the beginning of a swing to silica cleaning and thickening grades against the use of chalk and other abrasive minerals having poor fluoride compatibility. This swing still continues today.

Since those days, our outstanding capacity to innovate and build on a silica material expertise has never stopped.

SYLODENT® / SYLOBLANC®
Toothpaste Silica

Grace Davison offers an extensive toothpaste silica portfolio and technologies. You can count on more than 150 years of innovations in new products and materials science.

More Than 40 Years Dedication To Toothpaste Silica And Technology

Some of our key cornerstones:

1969  Lever Brothers is granted a US patent for the first toothpaste containing a silica (Grace SYLOID® 63 Silica)

1975  Grace launched its SYLOBLANC® Silica Toothpaste Portfolio

1979  Grace patented hydrous silica gel abrasives

1986  SYLODENT® Silica Trademark granted in U.S.

1987  SYLODENT® 700 Silica Series of abrasive siliconas developed and launched

2001  Grace acquired Akzo PQ silica business entering into precipitated silica technology

2004  Grace invents a customized innovative high-cleaning, low-abrading toothpaste silica grade

2010  Grace launched its new multi-purpose cleaning silica grade SYLODENT® SM 850C Silica able to guarantee maximum latitude to formulators meeting the needs of several Toothpaste market segments
Silica Production Technology

For over a century, Grace Davison has been a recognized silica based technology leader offering one of the largest silica product portfolios able to add value to a great variety of businesses and industries.

In the Toothpaste business our offering of specialty silicas includes precipitated silica and silica gel products, which due to their specific nature and characteristics provide unique properties to a toothpaste formulation. Synthetic silica, is basically the result of a chemical reaction between sodium silicate and an inorganic acid, followed by polymerization, growth and aggregation of primary particles. By controlling a set of physical and chemical parameters like temperature, pH and electrolytes content among others, we are able to produce a wide array of silicas spanning from silica gel to precipitated silica grades having different characteristics.

Grace combines the best of both technologies in developing the optimum dental silica grades
Cleaning Agents

The primary function of cleaning agents is to provide the necessary cleaning and stain removal to the toothpaste formulation. Typically, cleaning is directly correlated to the abrasivity of silica on tooth dentin and measured by RDA\(^*\). In other words, the higher the RDA, the higher the abrasivity. Even though this is typically true, some of our cleaning grades are able to provide high cleaning efficiency at reduced level of abrasion when compared with competitive cleaning grades.

We leverage our capability to produce both silica gel and precipitated silica based cleaning agents to provide a broad set of options to the formulator, ranging from specialized functionality to efficient cleaning and value. The range of cleaning silicas produced by Grace offer a wide latitude in RDA. There is a fair deal of complexity in the formulation process as to selecting the right type of silica and dosage level to achieve optimum PCR/RDA\(^{**}\) ratio.

The range of cleaning silicas produced by Grace offer a wide latitude in RDA (Radioactive Dentine Abrasion) and PCR (Pellicle Cleaning Ratio), a broadly accepted indicator of the cleaning ability of the toothpaste. There is a fair deal of complexity in the formulation process as to selecting the right type of silica and dosage level to achieve optimum PCR/RDA ratio. Generally, as the abrasivity increases, so does the PCR. However, there are some differences between our silica grades. Please contact your Grace representative to get a recommendation for your particular system.

Mouthfeel, viscosity and consistency are all variables affected by the choices of cleaning and thickening agents, loading and other ingredients such as binders used in the formulation. The values in the following charts are provided for reference only.

Another way to determine the best suited cleaning agent from our portfolio is by considering the specific performance characteristics that you want to provide to your toothpaste formulation.

Our most recommended Cleaning grades are SYLODENT\(^\circ\) 750 and SM 850C silicas, given their versatility and overall cost/performance ratio.

\(^*\) RDA=Radioactive Dentin Abrasion
\(^{**}\) PCR= Pellicle Cleaning Ratio

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Thickening Agents

The primary function of thickening silica is to build viscosity, without increasing the level of abrasion (RDA) in the overall formulation. Also, they can be used as texturing agents in formulations that use alternative abrasives other than silica.

In addition to having a substantial impact on the viscosity of the toothpaste system, the thickening silica also plays a role in the mouthfeel of the paste. If the level of the cleaning agent in the system is low, then the formulator may wish to use a less efficient thickener to achieve an overall solids level consistent with the desired mouthfeel.

In general, the paste formulation should include at least 15% up to 30% total silica concentration. The split of this percentage between thickener and cleaning agent depends on the choice of silicas, desired cleaning level, etc.

The viscosity of the toothpaste will develop over time. Usually, within 5-10 days after manufacturing the viscosity stabilizes and does not increase significantly on further aging. Viscosity stability of the toothpaste is an important parameter that needs to be confirmed prior to commercialization as it is also a good indicator of any ingredient incompatibility. Stability curves are shown below.

As with our abrasives, there are several considerations to determine the right type and dosage of thickener silica. Mouthfeel and “ribbon stand-up” can be improved by the addition of thickener. Once again, these guidelines must be taken in consideration of the interactions with the abrasive, the humectant system, actives and all other ingredients.
Dentifrice Optical Properties and Refractive Index Control

The clarity of a dentifrice is heavily dependent on matching the refractive index (RI) of the cleaning and thickening silica agents to that of the humectant phase in the formula. SYLODENT® and SYLOBLANC® silicas have refractive indices ranging between 1.44 to 1.46 that will allow customers to achieve high clarity dentifrices.

Glycerine is often an important part of the humectant system for its effect on the appearance and smoothness of a toothpaste, but it exhibits interaction with the silicas and thereby will play a role in achieving pastes with high clarity.

Generally, thickening silicas have less interaction with humectant components than their cleaning counterparts. Therefore, if the formulator is attempting to achieve a high clarity toothpaste, the cleaning system – silica type and concentration, should be established before deciding on the thickening system.

Using sorbitol as a component of the humectant system at a significant level, provides more latitude in achieving a high clarity toothpaste.
Application & Lab Capabilities

With over 40 years of experience and a global presence, our Consumer Lab specialists are dedicated to helping you in extracting maximum value from the use of our wide toothpaste silica offering and suggesting formulation modifications where necessary. We offer our customers the following:

State of the art lab capabilities

- Excellent in-house service support capabilities
- Fully equipped state-of-the-art laboratories
- Highly trained personnel
- Starting point formulations and advice upon request
- Full range of evaluations
  - Brookfield Viscosity
  - Fluoride Availability – ionic F
  - Clarity and Refractive Indexes
  - Paste Density
  - pH
  - Acrylic paste abrasion (APA)
  - Paste stability – accelerated aging test
  - Stain Removal Cleaning (PCR) – (outside lab)
  - Radioactive Dentin Abrasion (RDA) – (outside lab)

Application capabilities

- Low to high abrasivity pastes and gels
- Micro cleansing
- Baking Soda (~10% Sodium Bicarbonate)
- Anti-Tartar (~1.5% TSPP)
- Sensitive Teeth (~5% Potassium nitrate)
- Anti-Bacterial (~0.3% Triclosan)
- Dentifrice Preparation
  - Various types of dispersing equipment
  - 2 kg Premier® Mixers
  - Heat seal for tubing
Research & Development, Technical Customer Service (TCS)

Grace Davison 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 to accommodate the increasing wants and needs of our customers.

We have in place a Global TCS group, consisting of experienced professionals, who support our worldwide toothpaste business. The team is dedicated to developing technical partnerships with our customers in the effective use of our SYLODENT®/SYLOBLANC® Silica products.

Our rapid response support activities include on-site or on-the-phone consultation, formulation assistance and technical problem-solving. Our Application Development Laboratories (TCS Group) perform project work and investigations into specific customer-driven opportunities.

The TCS group, while centrally managed, is regionally based, providing both local know-how and global support. Grace Davison runs a Global Toothpaste Technical Center of Excellence in Columbia, MD-USA and 3 regional Technical Service Lab located in Worms-Germany, Sorocaba-Brazil, Kuantan-Malaysia.

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 developing successful partnerships the world over.

Packaging

We offer a wide range of flexible packaging options for our SYLODENT®/SYLOBLANC® Silica products, including:

- Specialized multilayer valve bags on pallets
- Customized big bag options
- Silo/bulk trucks for bulk deliveries

The prompt delivery of SYLODENT®/SYLOBLANC® Silica is assured through our global production facilities.

Safety Issues

Safety is a priority at Grace. SYLODENT®/SYLOBLANC® Products are approved products by a variety of international authorities such as the European Directive 2008/EC for E 551 and the FDA (for indirect food contact) and is fully REACH registered. For further information, our EHS department will offer assistance.

Quality Management

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

- All our facilities are ISO 9001 and 14001 certified, and we implement internal and external audits to find ways to improve our processes and services.
- We employ Statistical Process Controls (SPC) to monitor and analyze 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 groups of marketing, research and development as well as customer service. Our dedicated workforce is an important asset and customer satisfaction is our most important objective.

The Six Sigma® Advantage

At Grace Davison, we are committed to a Quality Management System, including the continuous improvement of our processes. To maintain Grace Davison’s high standards, we employ Grace’s Six Sigma® tools. These were designed to investigate process parameters, quantify their effects and optimize 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.
As a premier specialty chemicals company, it is one of Grace's utmost priorities to comply with all relevant legislation, including REACH. Therefore, in November of 2008, we undertook extensive efforts to achieve compliance of all our products, substances and formulations. Since the beginning of 2010, our main products including synthetic amorphous silica, zeolites and synthetic amorphous silicates are all registered under REACH. Regardless of which product you buy from us in the EU, you can be assured that all necessary steps have been taken to ensure continuous and smooth supply of your products.

**Global Scope**

**REACH Information Portal**

To better answer the increasing number of customer requests, we have established an interactive internet webpage [www.grace.com/REACH](http://www.grace.com/REACH). On this website you will find our standardized statements regarding the implementation status for REACH, as well as the registration status of our manufactured substances.

Please follow the given guidelines so that you will receive an access code for the individual search portal of Grace pre-registration/reference numbers. The search function is based on the CAS no., which is provided in Chapter 3 of the product MSDS.
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 Davison has met all REACH requirements for the given deadline for Tier 1, December 1, 2010, and can hereby assure today’s and future customers full REACH compliance of its products. This assurance also includes the very diverse use of a spectrum of our products.

World Headquarters
W. R. Grace & Co.-Conn.
7500 Grace Drive
Columbia, Maryland 21044/USA
Tel.: +1 410 531 4000
NA Toll Free: +1 800 638 6014

North America
W. R. Grace & Co.-Conn.
62 Whittemore Ave.
Cambridge, MA 02140/USA
Tel.: +1 617 498 4987
www.gracedarex.com

Latin America
Grace Brasil Ltda
Rua Albion, 229 - 10o andar, cj 104
Lapa, São Paulo - SP/Brasil
Cep: 05077-130
Tel.: +55 11 3133 2704

Europe
Grace GmbH & Co. KG
In der Hollerhecke 1
67545 Worms/Germany
Tel.: +49 6241 403 00

Asia/Pacific
Grace China Ltd.
19th Floor, K Wah Centre
1010 Huai Hai Zhong Road
Shanghai, 200031/ China
Tel.: +86 21 5467 4678

www.grace.com

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