

SILFOAM® | ANTIFOAM AGENTS | QUALITY & ECONOMY

SILFOAM® STRIKES A BALANCE BETWEEN QUALITY AND ECONOMY

Dear Valued Customer,

WACKER is pleased to provide you this handy resource to support your business needs. In the SILFOAM® Product Manual contents you have access to the following:

Overview

- [SILFOAM® Technology Overview](#)
- [Application and Use](#)

Textiles

- [SILFOAM® Textile Technology Overview](#)
- [Product Information Chart](#)
- [How to Select a Silicone Antifoam Agent](#)

Pulp & Paper

- [PULPSIL® Technology Overview](#)
- [Product Information Chart](#)

Life Sciences

- [SILFOAM® & Applications Overview](#)
- [Pharma Product Information Chart](#)
- [Food Product Information Chart](#)
- [Agro Product Information Chart](#)

Water Treatment

- [Product Information Chart](#)

Oil and Gas

- [Oil & Gas Overview](#)
- [Product Information Chart](#)

Dispersion

- [SILFOAM® Advantages](#)
- [Product Information Chart](#)

General Industry

- [Product Information Chart](#)

We hope you find this information to be of value, lending technical assistance right at your fingertips. For more product detail go to www.wacker.com and choose "Product Search, TDS & MSDS" from the bottom navigation panel.

Please contact your local sales representative should you have further needs. Thank you for your business and continued support!



WACKER ANTIFOAM AGENTS – INNOVATIVE, CUSTOM SOLUTIONS

Silicone-based antifoam agents from WACKER offer an effective and flexible alternative. Get the benefit of optimum performance and stable product quality.

For many foam-intensive industrial processes, however, foam is disruptive and the cause of various production problems.

Foam can lower process efficiency and reliability and impair product properties. The end result is lower productivity, poorer economics and inferior product quality. So, how much foam does a process or product need in order to be effective, and how can it be regulated effectively? The smart way to find out is to use a high-quality, silicone-based antifoam agent from WACKER.

Our foam-control systems are general-purpose, ready-to-use products that are easy to process, economical, and individually tailored to your demands.

SILFOAM® Antifoam Agents – Integrated, Sustainable Solutions

SILFOAM® SC

Silicone Antifoam Compounds

- Oily, viscous, opaque or slightly cloudy liquids
- Mostly used in systems containing little or no water
- Compounds can be used neat or mixed with suitable formulation components such as surfactants.

SILFOAM® SD

Self-Dispersing Silicone Antifoam Agents

- Combination of antifoam agent compounds with organic active agents and auxiliaries
- Disperse spontaneously in contact with foaming formulations
- Show particularly good distribution and compatibility

SILFOAM® SE

Silicone Antifoam Emulsions

- O/W emulsions of antifoam agent compounds with an active ingredient content of 5 to 50%
- This product form is mainly used for water-based formulations and applications

SILFOAM® SP

Silicone Antifoam Powders

- The powder-form antifoam agents are specifically intended for powder products, e.g. powder detergents.

- **PULPSIL®**

Silicone Antifoam Compounds and Emulsions, as well as Silicone Surfactants

- Specifically developed for use in the pulp and paper industry

SILFAR®

Silicone Product Range (Dimethicones, Simethicones, Antifoam Agents, Active Substances and Auxiliaries)

- Specially developed for use in the pharmaceutical industry and related life sciences

WACKER® AK

Silicone Fluids

- Are characterized by good antifoam properties in water-free, non-polar systems
- Suitable for applications in which compatibility with other substances is not required

Service Solutions – Flexible and Customized

Individual problems require individual service solutions – these are provided by our teams of experts.

The main criterion is whether the WACKER antifoam agent is compatible with your formulation.





Since the silicone-based antifoam usually has different solubility and dispersibility from those of the formulation components, it is necessary to choose a largely compatible antifoam product*. In contrast, relatively incompatible antifoam agents can be very efficient and so a balance must be struck between efficiency and compatibility. Our experts will be glad to assist you in solving this problem. You have the opportunity to perform detailed compatibility tests on your system with several products to determine the optimum WACKER antifoam agent.

SILFOAM® Antifoam Agents – Application and Use

Correct handling of foam-control systems will ensure you get the best results. Some important aspects of using WACKER antifoam agents are discussed below:

Metering

- The optimum dosage of SILFOAM® antifoam agents in customer systems is determined by preliminary tests
- Good distribution of the highly active SILFOAM® products in the medium to be defoamed is essential for high efficiency

- In calculating the optimum amount to use, remember, during mixing, to allow enough antifoam agent present to compensate for any loss of effect due to storage or dispersion
- In metering SILFOAM® by pump, we recommend using low-shear equipment capable of precisely metering small amounts.

Dilution

- Antifoam compounds can be incorporated homogeneously by diluting them with suitable solvents, such as white spirit, ester or isopropyl alcohol
- Viscous antifoam emulsions can be diluted by adding successive amounts of cold water in ratios of 1:1 – 1:10
- To keep dilute emulsions stable for longer periods, we recommend adding thickeners, such as carboxymethyl cellulose or polyacrylic acid solutions

Shear Stability

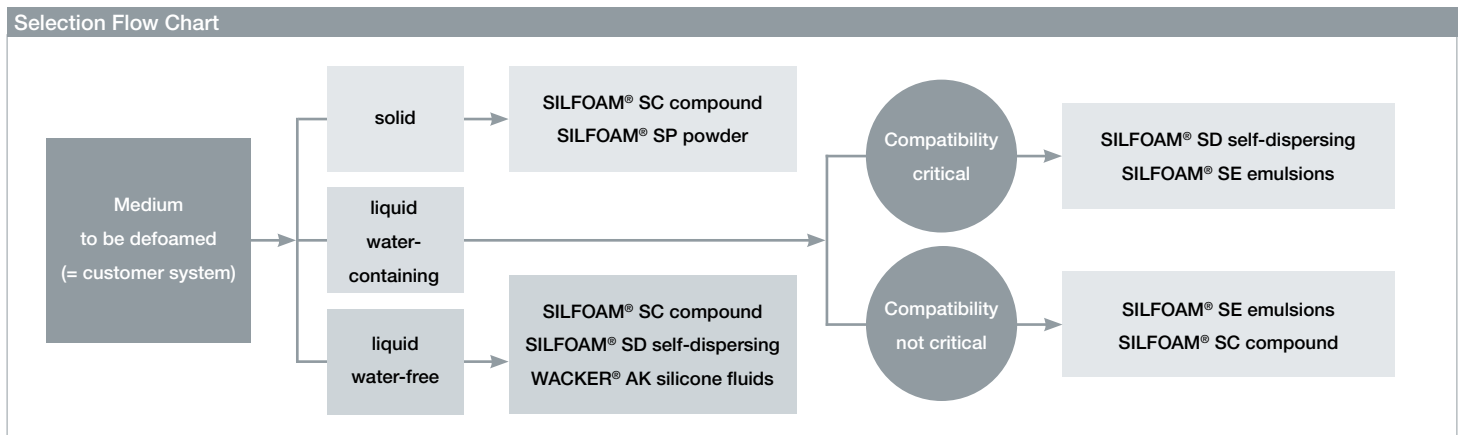
- Shear forces can impair the effectiveness of SILFOAM® antifoam agents
- With readily compatible antifoam agents, the shear force leads to rapid dispersion of the antifoam and often distributes it so finely that it quickly becomes exhausted

- With antifoam agents that are relatively incompatible, the shear forces can cause the antifoam to agglomerate and separate out. Pre-dispersed product such as emulsions offer
- Pre-dispersed products such as emulsions offer advantages as long as the shear forces are not too high

Storage Stability

- Silicone antifoam compounds resist high and low temperatures. We recommend storage at room temperature
- Self-dispersing silicone antifoam agents are best kept at room temperature
- Silicone antifoam emulsions are best stored at between 5 and 25 °C. Temperatures above 30 °C or freezing temperatures can affect the resistance and dilutability
- Once opened, the drums should be carefully sealed to prevent microbial contamination.

* Foam-preventive substances are known as “antifoam agents,” foam-destroying agents are called “defoamers.” SILFOAM® foam-control systems are multifunctional, i.e. they act as antifoam agents or defoamers, or perform both functions depending on the application.



SILFOAM® | TEXTILES | QUALITY & EFFICIENCY

OPTIMIZE PRODUCT PROCESSES WITH QUALITY FOR TEXTILE APPLICATIONS

SILFOAM® foam-control systems – as silicone-based process and product defoamers - provide clear quality and efficiency advantages in all textile processes.

Foam can be generated during several important phases of textile processing, and when it occurs, it almost always results in lower quality and reduced efficiency. This is because foam affects the properties of textiles, which can then disturb sensitive process workflows. For example, it can lead to uneven coloring during textile dyeing.

This is exactly what SILFOAM® foam-control systems are designed to prevent. They are highly efficient, with low chemical reactivity, have a wide spectrum of action and can be used in two different ways. As process defoamers added directly to the treatment liquor, they regulate foam build-up during the ongoing process. Or they can be employed purely as a product defoamer, added to textile auxiliary formulations to become active when a potentially foamable product is in use.

Advantages

- Highly efficient
- Low dosage requirements result in no loss in product functionality and thus savings in material and costs.
- Broad range of applications
- Largely chemically inert, thus no reaction with the foaming substances
- Do not impair the wetting action of defoamed surfactants

One Product, Many Solutions – the Choice Is Yours

Ionic Character

- WACKER silicone antifoam emulsions have various ionic characters; this considerably reduces the risk of precipitation caused by surfactant components with different ionic characters (e.g. anionic, cationic or amphoteric wetting agents).
- There is also a wide range of non-ionic silicone antifoam agents, which ensures good compatibility with ionic emulsifiers.
- WACKER also offers anionic silicone antifoam agents for anionic auxiliaries.

Dispersing Properties

- Foam cannot be combated effectively unless the defoamer disperses readily in the medium to be defoamed.
- Silicones have an inherent ability to disperse rapidly and show little tendency to form deposits.
- Due to their oily, hydrophobic character, WACKER silicone antifoam agents (compounds) only disperse well in the presence of a sufficient quantity of redispersants.

Influence of the Medium (pH)

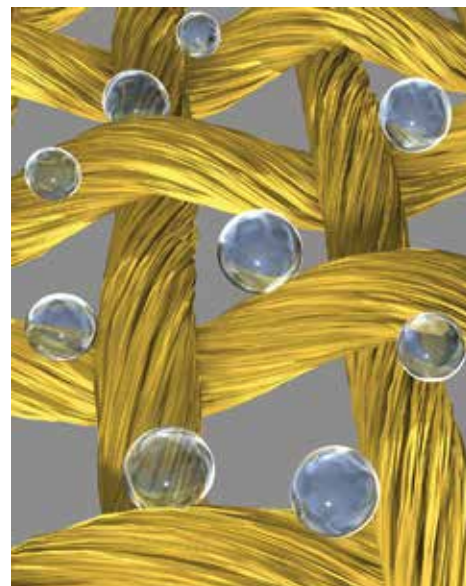
- WACKER silicone defoamers show excellent persistence
- Since the defoamers' efficacy can decline rapidly under the influence of strongly alkaline formulations, WACKER offers alkali-resistant silicone antifoam emulsions for such textile applications as bleaching, reactive dyeing and mercerizing.
- Preliminary tests should be carried out to ensure resistance to chemical and thermal effects.

Self-Emulsifying Property

- WACKER self-emulsifying silicone antifoam agents show good dispersibility and compatibility, especially in applications characterized by poor spreading.
- They disperse immediately on contact with water to form fine-particle emulsions.

Resistance to Boiling

- During bleaching and disperse dyeing of polyester fabrics, WACKER silicone antifoam agents are exposed to temperatures ranging from 80 to 130 °C (jet dyeing machines).
- It is important here that the antifoam agent remains fully effective and does not coagulate.
- WACKER has developed special heat-resistant silicone antifoam agents for applications of this kind.





Shear Stability

- Shear forces caused by high process speeds have a major impact on defoamer efficiency, resulting in reduced foam suppression or emulsion breakdown.
- If the defoamer is highly compatible with the medium to be defoamed, shear forces disperse the defoamer too finely. The result is decreased defoamer activity.
- Pre-dispersed silicone antifoam emulsions improve efficacy, provided the shear forces are not too high.

Compatibility

The textile processing chain places a variety of stringent demands on silicone defoamers:

- For process defoaming, the defoamer selected should not produce deposits or disrupt the process in any way (coagulation, spot formation on the textile substrate, etc.).
- For product defoaming, it is important to use a largely stable defoamer which disperses uniformly.
- This requires preliminary compatibility tests, where an amount of 0.5 to 2% WACKER silicone antifoam agent is added to the formulation.

- Depending on requirements, samples are examined several days later (for noticeable changes, such as flocculation, sedimentation or pronounced clouding). Formulations that appear to be largely homogeneous are then tested for their defoaming activity.

Used as a process defoamer, SILFOAM® optimizes a range of textile production processes, from fiber manufacturing to dyeing and design.

Process Defoaming

In process defoaming (also known as external defoaming), a silicone antifoam agent is added periodically to regulate foaming in a running process. The top priority here is that the properties of the antifoam agent should not be affected by processing conditions. Above all, the antifoam agent must be highly heat resistant, resistant to alkalis and highly resistant to shear forces.

SILFOAM® effectively combats and controls the formation of unwanted foam during all phases of production in the following processes:

Fiber Production

- Monomer synthesis
- Polymerization
- Finishing

Fiber Processing

- Sizing
- Chemical bonding of nonwovens

Pretreatment

- De-sizing
- Bleaching
- Bucking / kier boiling
- Mercerizing
- Washing

Dyeing and design

- Dyeing
- Printing and space dyeing
- Steaming
- Rinsing

Treatment

- Softening
- High-grade finishing
- Optical brightening
- Hydrophobic finishing
- Coating of textiles

Wastewater

- Defoaming of textile wastewater

Textiles								
SILFOAM®	Application	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type	
SE 55 A	Universal	50	40	1,650	8.5	Non-ionic	Emulsion	
SRE	Universal	33	20	150	7.0	Non-ionic	Emulsion	
SD 100 TS	Polyester dyeing (jet)	100	100	6,000	-	-	Self-dispersing	
SD 670	Basic binder/deaeration	100	100	150	-	-	Self-dispersing	
SD 882	Textiles/deaeration	100	100	20	-	-	Self-dispersing	
SC 132	Wetting agent formulations for bleaching processes	100	100	20,000	-	-	Compound	
SC 385	Wetting agent formulations	100	100	300	-	-	Compound	

Product Recommendations

General-Purpose Applications

Here, we recommend emulsion SILFOAM® SRE.

Wetting Agent Formulations

The highly alkali-stable emulsion SILFOAM® SE 55A is especially suitable for wetting agent formulations.

Polyester Dyeing in Jet Dyeing Machines

For this special application, we recommend the heat-stable SILFOAM® SRE emulsion, and the self-emulsifying SILFOAM® SD 100 TS antifoam agents.

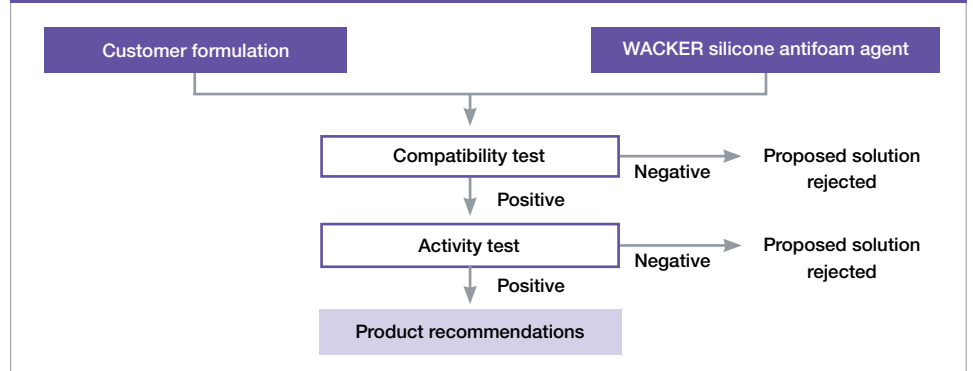
Improved Textile Properties

SILFOAM® product defoamers provide effective, persistent foam control in your textile system.

Product Defoaming

During product defoaming – or internal defoaming as it is also called– the antifoam agent is added preemptively to a system or a component, such as a textile auxiliary formulation. The defoamer then becomes active when the foamable product is used. The main problem during product defoaming is to strike a balance between an antifoam agent's activity and its compatibility with the medium being defoamed – for these two properties tend to be mutually exclusive. Thus, antifoam agents with very good compatibility often exhibit rather low defoaming activity. In contrast, a high defoaming efficacy may have a negative effect on processing problems or product properties.

How to select a silicone antifoam agent



In addition to an antifoam agent's stability at various pH values, its ionic activity also plays an important role. Components with different ionicity often lead to precipitation. WACKER has a large selection of nonionic antifoam agents showing excellent compatibility with such ionic emulsifiers.

which is highly suitable for systems where flow is critical – has its specific advantages.

Deaeration and Applications for Systems where Flow Is Critical

We recommend SILFOAM® SD 882 for these specialized application areas.

Product Recommendations

Wetting Agent Formulations

SILFOAM® SE 55A antifoam emulsion is particularly suited for use in wetting agent formulations. Each of these compounds – SILFOAM® SC 132 and SILFOAM® SC 385,



PULPSIL® | PULP & PAPER | STABILITY & EFFICIENCY

PULPSIL® STRIKES A BALANCE BETWEEN STABILITY AND EFFICIENCY

High and stable product quality and efficient processes are the best prerequisites for optimal pulp manufactures. PULPSIL® offers the all-round, sustainable solution.

PULPSIL® foam-control agents not only increase production capacity and reduce water and energy consumption; they also reduce the amounts of bleaching chemicals needed and optimize pulp washing. At the same time, despite their outstanding effectiveness, PULPSIL® products are formulated to produce virtually no deposits during pulp production. All PULPSIL® emulsions show exceptionally well balanced properties, ensuring excellent performance during pulp production processes and also a long shelf life at 0-40 °C.

The most important process for producing chemical pulp is the kraft process. Foaming problems often occur because of the high mechanical shear forces and the large amount of air entrained in the liquor. To ensure pulp manufacturing processes run smoothly and consistently, therefore, it is essential to use defoamers with good dewatering properties.

Advantages

- Higher pulp quality thanks to improved washing
- Faster dewatering
- Increased production capacity
- Reduced deposits during the pulp manufacturing process
- Sustainable production thanks to less soda loss and reduced washing-water and bleaching-chemicals consumption.

Product Recommendation

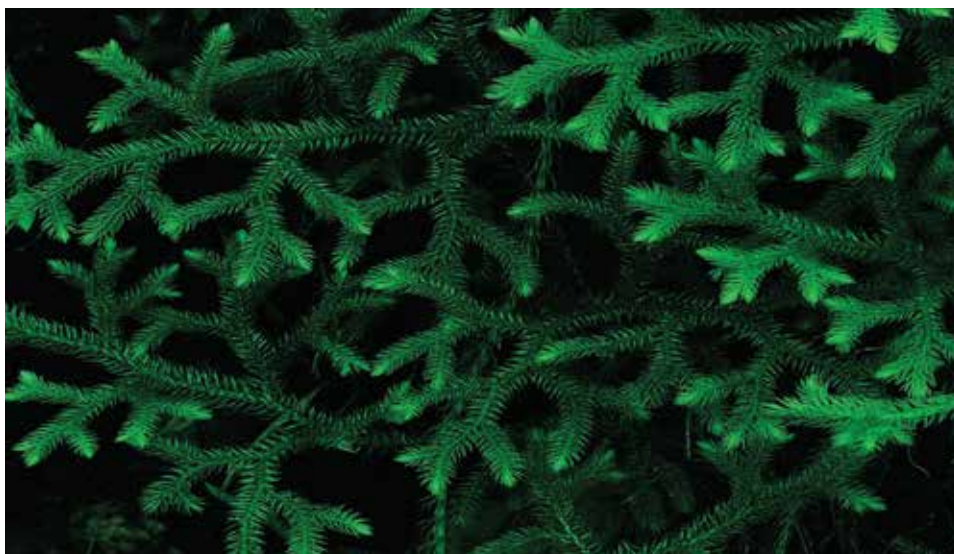
PULPSIL® 160 C, 235 C and 260 C
PULPSIL® 160 C, 235 C and 260 C feature a good balance of properties such as handling, emulsification, fast knock-down and persistence, making them ideal for efficient foam-control formulations in the pulp industry. Choose the appropriate PULPSIL® product for your particular requirement:

- PULPSIL® 160 C – deposit control, fast knockdown and persistence
- PULPSIL® 235 C – good persistence (foam suppression)
- PULPSIL® 260 C – very fast knockdown (foam collapse)

The amounts required are of the order of 0.01 to 0.20 kg per metric ton of pulp. However, the precise quantity depends to a large extent on the medium to be defoamed and the process conditions.

PULPSIL® 955 S and 960 S

PULPSIL® 955 S is a water-soluble silicone surfactant. PULPSIL® 960 S, however, is a water-dispersible silicone surfactant. Above their cloud points, both have a slight defoaming effect and outstanding dewatering properties. The cloud point of PULPSIL® 955 S is approximately 39 °C and that of PULPSIL® 960 S is approximately 23 °C. PULPSIL® 955 S and PULPSIL® 960 S are particularly suitable for foam-control formulations that are required to have a good defoaming effect and also improved drainage properties.



PULPSIL®	Application	Feature	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
160 C	Defoamer formulation	Deposit control, good knock-down and persistence (foam suppression)	100	100	20,000	-	-	Compound
235 C	Defoamer formulation	Good knock down and excellent persistence (foam suppression)	100	100	60,000	-	-	Compound
238 C	Defoamer formulation	Deposit control, good knock down and excellent persistence (foam suppression)	100	100	20,000	-	-	Compound
246 C	Defoamer formulation	Excellent knock down and persistence (foam suppression)	100	100	60,000	-	-	Compound
260 C	Defoamer formulation	Excellent knock down and good persistence (foam suppression)	100	100	50,000	-	-	Compound
355	Pulp production process	Excellent knock down and persistence	100	100	2,500	-	-	Concentrate
449	Defoamer formulation	Good knock down; Excellent drainage	100	100	7,000	-	-	Concentrate
480	Defoamer formulation	Excellent persistence (foam suppression)	80	80	70,000	7	Non-ionic	Emulsion
955 S	Defoamer formulation Pulp production process	Excellent drainage	100	100	800	-	-	Surfactant
960 S	Defoamer formulation Pulp production process	Good drainage and defoaming	100	100	1,300	-	-	Surfactant



SILFOAM® | LIFE SCIENCES | PHARMA – FOOD – AGRO

SILFOAM® STRIKES BALANCE BETWEEN MEETING REGULATIONS & OPTIMIZATION

SILFOAM® and SILFAR® Can Turn Your Innovative Technologies into Marketable Products.

Antifoam agents from WACKER can help you to do just that because they are designed to improve your processes and products. All our foam control products conform to specific regional requirements.

Chewing gum, beverages, plant protection agents, pills and medical equipment are just a few examples of products that affect our daily lives in more ways than we might realize at first glance. Current developments, particularly in the agricultural, food and pharmaceutical industries, have changed the way we live and made life easier.

Many medications, enzymes and foodstuffs could not be manufactured at all without the help of classical fermentation and modern biotechnology processes. Most of these highly specialized, life science processes, however, have serious problems with foam generation. Foam can adversely affect the quality of sensitive products and processes. For this reason, among the numerous additives needed to control these complex processes, foam control systems play a decisive role in their efficacy.

WACKER SILFOAM® and SILFAR® foam control products offer a tailored problem-solving system for a wide variety of highly specialized applications. They can be used as selected process auxiliaries or even as active ingredients. Classic life science application areas for our antifoam agents

include:

- Fermentation processes for the manufacture of antibiotics, pharmaceutical raw materials, food products, enzymes, bioethanol and biogas
- Agrochemical formulations such as suspension concentrates
- Food industry processes such as the manufacture of beverages.

Advantages

- Highly efficient
- Conforms to specific national requirements
- Wide range of applications
- Improved manufacturing processes and product quality
- Certified production of some WACKER silicone antifoam agents as per, for example, GMP and HACCP.

GMP Standard

For applications requiring the GMP standard, we recommend our SILFAR® S 184 silicone-based antifoam agents and the corresponding emulsion SILFAR® SE 4, which are produced according to cGMP (current Good Manufacturing Practices) for APIs (Active Pharmaceutical Ingredients).

Note

The applications mentioned in the table from the human sector also apply by analogy to related areas from veterinary medicine.



SILFOAM® | LIFE SCIENCES | PHARMACEUTICALS

WACKER OPTIMIZES PHARMACEUTICAL PRODUCTS & PROCESSES

We Are Specialists in Optimizing Pharmaceutical Products and Processes

The efficient active ingredients and auxiliary substances of our SILFAR® foam control products for the pharmaceutical industry ensure high pharmaceutical quality and meet the highest regulatory standards.

If pharmaceutical companies are to manufacture innovative high-quality pharmaceuticals, they must meet the legal standards of each country, down to the last detail. Particularly important is compliance with regulations describing the chemical com-

position of these products. WACKER has created a benchmark for pharmaceutical quality: SILFAR®

Our products meet the requirements of regulatory standards such as the monographs of the European Pharmacopoeia (Ph. Eur.) or the US Pharmacopoeia (USP). The same also applies to the individual ingredients that make up SILFAR® products.



Pharmaceutical								
SILFAR®	Application	Regulatory Standards	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
100	Antiflatulence, antacid	Ph. Eur., USP/NF compliant	100	100	100	-	-	Dimethicone
350	Antiflatulence, antacid, biotechnology processes	Ph. Eur., USP/NF compliant	100	100	350	-	-	Dimethicone
1000	Antiflatulence, antacid, biotechnology processes	Ph. Eur., USP/NF compliant	100	100	1,000	-	-	Dimethicone
S 184	Antiflatulence, antacid, biotechnology processes, liquid pharmaceutical preparations	Ph. Eur., USP/NF compliant, GMP	100	100	3,000	-	-	Simethicone
SE 4	Antiflatulence, antacid, biotechnology processes, liquid pharmaceutical preparations	Ingredients Ph. Eur., USP/NF compliant, GMP	33	30	3,000	4.0	Non-ionic	Simethicone emulsion

SILFOAM® | FOOD | DEFOAMER – PROCESSING

WACKER SPECIALIZES IN PERFECT FOOD PROCESSING

In the food-processing industry, foam is generated at various points in a production chain. This is caused mostly by surface-active substances such as proteins, fatty acids, and sugars. Invariably, the resulting foam impairs product properties in many different ways and greatly disrupts the process flow.

WACKER's SILFAR® and SILFOAM® high-quality product range ensures processes run smoothly and product qualities are improved in specific applications in the beverages industry, alcohol distillation, in

the production of deep-frozen foods, deep-frying oils, and gelatin as well as in fruit conservation and vegetable washing. A distinction, though, is made between food additive and food contact applications. When used as a food additive, the antifoam agent is added directly to the food and remains in it, e.g. during defoaming of juices. In a food-contact application, by contrast, the antifoam agent is contained in the packaging, such as plastic or paper, from which it can migrate into the food.



Food SILFOAM®	Application	Regulatory Standards	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
SC 200	Fat-based systems	FDA 21 CFR 173.340, 175.105, 176.170, 176.180, 176.200, and 176.210; NSF Category Code 3D and Q5; Kosher	100	100	4,000	-	-	Compound
SC 203	Fat-based systems	FDA 21 CFR 173.340, 175.105, 176.170, 176.180, 176.200, and 176.210; NSF Category Code 3D and Q5; Kosher	100	100	2,500	-	-	Compound
SE 11	Water-based systems	FDA 21 CFR 173.340, 175.300, 176.170, 176.180, 176.200, 176.210, 177.2600, and 178.3400; NSF Category Code 3D and Q5; Kosher	10	6	1,000	4.3	Non-ionic	Emulsion
SE 20	Water-based systems	FDA 21 CFR 173.340, 175.300, 176.170, 176.180, 176.200, 176.210, 177.2600, and 178.3400; NSF Category Code 3D and Q5; Kosher	20	13	1,000	4.3	Non-ionic	Emulsion

Food								
Tradename	Applica- tion	Regulatory Standards	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic char- acter	Product type
SILFOAM®								
SE 21	Water-based systems	FDA 21 CFR 173.340, 175.300, 176.170, 176.180, 176.200, 176.210, 177.2600, and 178.3400; NSF Category Code 3D and Q5	17	10	3,000	4.3	Non-ionic	Emulsion
SE 23	Water-based systems	FDA 21 CFR 173.340, 175.300, 176.170, 176.180, 176.200, 176.210, 177.2600, and 178.3400; NSF Category Code 3D and Q5	40	30	5,000	4.3	Non-ionic	Emulsion
SE 33	Water-based systems	FDA 21 CFR 173.340, 175.300, 176.170, 176.180, 176.200, 176.210, 177.2600, and 178.3400; NSF Category Code 3D and Q5; Kosher	30	20	1,500	4.3	Non-ionic	Emulsion
SE 2661	Water-based systems	FDA 21 CFR 173.340, 175.105, 175.300, 176.170, 176.180, 176.200, and 176.210; BfR XIV, XV, and XXXVI; Plastics Implementation Measure (PIM) (EU) No. 10/2011; Kosher	23	20	12,000	5.0	Non-ionic	Emulsion
SILFAR®								
350	Fat-based systems	FDA 21 CFR 173.340, 175.105, 175.300, 176.170, 176.180, 176.200, 176.210; Regulation (EC) No.333/2008 on food additives and food contact; BfR XIV, XV XXXVI, Plastics Implementation Measure (PIM) (EU) No. 10/2011; Kosher	100	100	350	-	-	Fluid
1000	Fat-based systems	FDA 21 CFR 173.340, 175.105, 175.300, 176.170, 176.180, 176.200, 176.210; Regulation (EC) No. 333/2008 on food additives and food contact; BfR XIV, XV XXXVI, Plastics Implementation Measure (PIM) (EU) No. 10/2011; Kosher	100	100	1,000	-	-	Fluid
S 184	Fat- or water-based systems	FDA 21 CFR 173.340, 175.105, 175.300, 176.170, 176.180, 176.200, 176.210; Regulation (EC) No. 33/2008 on food additives and food contact; BfR XIV, XV XXXVI, Plastics Implementation Measure (PIM) (EU) No. 10/2011; Kosher	100	100	3,000	-	-	Compound
SE 4	Water-based systems	FDA 21 CFR 173.340, 175.105, 175.300, 176.170, 176.180, 176.200, 176.210; Regulation (EC) No. 33/2008 on food additives and food contact; BfR XIV, XV XXXVI, Plastics Implementation Measure (PIM) (EU) No. 10/2011; Kosher	33	30	3,000	4.0	Non-ionic	Emulsion

SILFOAM® | AGRO | DEFOAMER – YIELDS

WACKER SPECIALIZES IN GOOD YIELDS

We Are Specialists in Good Yields

SILFOAM® grades ensure effective foam control in all agrochemical production processes and a wide range of applications for plant protection agents.

The world's population is growing steadily. Whereas, in 1950, only 2.5 billion people needed to be fed, that figure had already risen to 7.0 billion by 2011. This has created ever greater challenges for agriculture and agrochemistry. The problem would be almost impossible to solve without efficient processing aids. With its process-optimiz-

ing SILFOAM® antifoam agents, WACKER has made an important contribution to solving this problem.

These specialized products provide effective and long-lasting foam control in production processes for various plant protection formulations. For manufacturers of plant protection agents, SILFOAM® facilitates smooth production and can be used in a wide variety of applications. Each of our SILFOAM® foam control products is available as a liquid concentrate (compound) or emulsion.



Agriculture									
SILFOAM®	Application	Regulatory standards	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type	
SC 132	SL, SC, SE, EW, SP, WP, WDG	EPA 40 CFR 180.910; may also be used as an inert ingredient on non-food crops	100	100	20,000	-	-	Compound	
SC 200	SL, SC, SE, EW, SP, WP, WDG	EPA 40 CFR 180.910 and 180.930; may also be used as an inert ingredient on non-food crops	100	100	4,000	-	-	Compound	
SC 203	SL, SC, SE, EW, SP, WP, WDG	EPA 40 CFR 180.910 and 180.930; may also be used as an inert ingredient on non-food crops	100	100	2,500	-	-	Compound	
SE 11	SL, SC, SE, EW, SP, WP, WDG	EPA 40 CFR 180.910 and 180.930; may also be used as an inert ingredient on non-food crops	10	6	1,000	4.3	Non-ionic	Emulsion	

Agriculture								
Tradename	Application	Regulatory standards	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
SILFOAM®								
SE 20	SL, SC, SE, EW, SP, WP, WDG	EPA 40 CFR 180.910 and 180.930; may also be used as an inert ingredient on non-food crops	20	13	1,000	4.3	Non-ionic	Emulsion
SE 21	SL, SC, SE, EW, SP, WP, WDG	EPA 40 CFR 180.910 and 180.930; may also be used as an inert ingredient on non-food crops	17	10	3,000	4.3	Non-ionic	Emulsion
SE 23	SL, SC, SE, EW, SP, WP, WDG	EPA 40 CFR 180.910 and 180.930; may also be used as an inert ingredient on non-food crops	40	30	5,000	4.3	Non-ionic	Emulsion
SE 33	SL, SC, SE, EW, SP, WP, WDG	EPA 40 CFR 180.910 and 180.930; may also be used as an inert ingredient on non-food crops	30	20	1,500	4.3	Non-ionic	Emulsion
SE 3060	SL, SC, SE, EW, SP, WP, WDG	EPA 40 CFR 180.920	33	20	150	6.5	Non-ionic	Emulsion
SP 150	SP, WP, WDG	EPA 40 CFR 180.910; may also be used as an inert ingredient on non-food crops	100	15	-	-	-	Powder
SILFAR®								
S 184	SL, SC, SE, EW	EPA 40 CFR 180.960; may be used as an inert ingredient in pesticide products applied to both food and non-food crops, to animals and in antimicrobial formulations.	100	100	3,000	-	-	Compound
WACKER®								
AK 350	EC	EPA 40 CFR 180.910 and 180.930	100	100	350	-	-	Silicone Fluid
AK 1000	EC	EPA 40 CFR 180.910 and 180.930	100	100	1,000	-	-	Silicone Fluid
AK 12500	EC	EPA 40 CFR 180.910 and 180.930	100	100	12,500	-	-	Silicone Fluid



SILFOAM® | WATER TREATMENT | PROCESS RELIABILITY

SILFOAM® STRIKES BALANCE BETWEEN PROCESS RELIABILITY & APPLICATIONS

SILFOAM® Antifoam Agents Give Clear Results in Wastewater Treatment – Effectively and Reliably.

Whether it is household sewage, wastewater from industry and agriculture, factories or rainwater runoff – most of the time this wastewater contains surface-active chemicals that generate foam. Foam build-up can adversely affect and significantly disrupt wastewater treatment in these facilities. SILFOAM® solves these problems reliably and permanently.

SILFOAM® antifoam agents from WACKER regulate and control the formation of foam during the various purification stages of

water treatment facilities. Our foam control systems can also be used to treat highly alkaline wastewater in the semiconductor sector as well as cooling water or textile-industry effluents. With their high efficiency, SILFOAM® antifoam agents enhance process reliability in the plant, permitting economical wastewater treatment.

Advantages

- Highly efficient
- Wide range of uses, even in highly alkaline wastewater and cooling water
- Higher process reliability
- Economical wastewater treatment

Service

Our antifoams are formulated to minimize their impact on the environment.

- The emulsifier in antifoam emulsions is biodegradable.
- Silica (SiO₂) is an inorganic substance that occurs as such in Nature.
- Polydimethylsiloxanes are initially bound in the sludge in wastewater treatment plants and subsequently, under appropriate conditions, undergo “abiotic” degradation, i.e. chemical degradation that is not assisted by microbes.

Water Treatment		Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
SILFOAM®	Application						
SE 1210	Industrial and municipal waste treatment	10	6	700	8.0	Non-ionic	Emulsion
SE 2210	Industrial and municipal waste treatment	20	13	700	8.0	Non-ionic	Emulsion
SE 3210	Industrial and municipal waste treatment	30	20	1,500	8.0	Non-ionic	Emulsion



SILFOAM® | OIL & GAS | VERSATILITY & RELIABILITY

SILFOAM® STRIKES BALANCE BETWEEN VERSATILITY & PROCESS RELIABILITY

With SILFOAM®, You Can Produce, Process and Refine Crude Oil while Benefiting from Reliable Processes and Versatile Applications

Even at the drilling stage, these valuable raw materials must be produced as efficiently and as free from impurities as possible in order to avoid intermediate reactions that would reduce quality. In the refining and processing of petroleum products, too, trouble-free production conditions are essential if operations are to be cost-effective. Unwanted foam formation during these processes leads to inefficient production and lowered product quality.

Advantages

- In oil and gas production, they optimize drilling fluid additives, drilling mud, well cementation, separation of crude oil and gas, and water separation
- In refineries, they are deployed effectively in distillation, gas sweetening and drying, deasphalting and in cracking processes.
- In processing and enhancing, they permit smooth and more efficient production conditions.
- They are available worldwide in a variety of different packaging sizes.

SILFOAM® antifoam agents permit the reliable and efficient extraction of petroleum and natural gas.



Gas/Oil Separation

In oil production, the gas dissolved in the crude oil is separated by pressure relief in gas/oil separators. Because of crude oil's complex composition, foam builds up. If foam emerges through the gas outlet, it seriously disrupts the downstream processes. The use of SILFOAM® antifoam agents and WACKER® AK silicone fluids keeps the foam safely and reliably within low volumes and ensures that the plant operates at full capacity.

Drilling Muds

Density is an important criterion for drilling mud. Deaeration with SILFOAM® antifoam agents effectively reduces the gas content and thereby decreases the compressibility.

Natural-Gas Production with Surfactants

To prevent the gas flow failing, surfactants are used in low-pressure natural-gas fields to foam the reservoir water. The resulting foam can be cost-effectively removed above ground by means of our silicone antifoam emulsions.

Well Cementation

To achieve the necessary stability and impermeability, entrained air must be avoided at all costs during well cementation. For this purpose, self-dispersing SILFOAM® products are added to concrete during processing to remove any contained gas.

Deaeration of Sea Water

In areas near the sea, seawater is a cost-effective source of process water. Its permanent contact with air results in a





relatively high oxygen content, which leads to corrosion and fouling in the treatment processes. The seawater is therefore degassed in vacuum deaerators. The foam that is generated during this process can be effectively reduced by means of SILFOAM® products.

Product Recommendation

Non-Aqueous Applications

The ready-to-use antifoam agent SILFOAM® SD 986 is already optimized for gas/oil separation and can also be used for non-aqueous drilling muds. WACKER® AK silicone fluids are available in a viscosity range to over 1 million mPa s for customers to make their own formulations.

Enhance the Processes in Your Refinery

Distillation

In distillation, both at atmospheric pressure and under a vacuum, foam affects separation quality and therefore reduces the available capacity. SILFOAM® antifoam agents effectively prevent foam generation.



Delayed Cokers

In the petroleum industry, delayed cokers are often subject to serious foaming under extreme conditions. Temperatures up to 500 °C require fast and effective foam control. High-molecular SILFOAM® antifoam agents minimize the amount of silicone that is transferred to downstream process stages.

Gas Sweetening with Amines

Corrosive components of gas streams, such as carbon dioxide and hydrogen sulfide, are removed by extraction. The various amines used for extraction have different foaming tendencies and require specifically tailored antifoam agents. Here, SILFOAM® will give you perfect results combined with good compatibility.

Oil and Gas SILFOAM®	Application	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
SC 132	Refinery	100	100	20,000	-	-	Compound
SE 55 A	Wastewater, Aqueous Drilling Mud, Well Cementing	50	40	1,650	8.5	Non-ionic	Emulsion
SE 21	Wastewater, Aqueous Drilling Mud	17	10	3,000	4.3	Non-ionic	Emulsion
SE 23	Wastewater, Aqueous Drilling Mud	40	30	5,000	4.3	Non-ionic	Emulsion
SE 1210	Wastewater, Aqueous Drilling Mud, Production	10	6	700	8.0	Non-ionic	Emulsion
SE 2210	Wastewater, Aqueous Drilling Mud, Production	20	13	700	8.0	Non-ionic	Emulsion
SE 3210	Wastewater, Aqueous Drilling Mud, Production	30	20	1,500	8.0	Non-ionic	Emulsion
SE 24	Wastewater, Aqueous Drilling Mud, Well Cementing	16	10	3,000	7.2	Non-ionic	Emulsion
SD 986	Gas/Oil Separators, Refinery, Non-Aqueous Drilling Muds	100	6	5	-	-	Self-dispersing
SD 860	Well Cementing, Tar Sands Defoaming	100	100	100	-	-	Self-dispersing
SD 670	Well Cementing, Tar Sands Defoaming	100	100	150	-	-	Self-dispersing
SP 150	Well Cementing	100	15	-	-	-	Powder

Oil and Gas WACKER®	Application	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
AK 1000	Production / Refinery	100	100	1,000	-	-	Silicone Fluid
AK 12500	Gas/Oil Separator	100	100	12,500	-	-	Silicone Fluid
AK 60000	Gas/Oil Separator	100	100	60,000	-	-	Silicone Fluid
AK 100000	Refinery	100	100	100,000	-	-	Silicone Fluid
AK 600000	Refinery	100	100	600,000	-	-	Silicone Fluid
AK 1000000	Refinery	100	100	1,000,000	-	-	Silicone Fluid
AF 98 10000	Gas/Oil Separator	100	100	10,000	-	-	Silicone Fluid
AKF 3385	Gas/Oil Separator	100	100	4,000	-	-	Silicone Fluid

Extraction

Foam also reduces capacity in the UDEX and sulfolane processes. Using SILFOAM® antifoam agents effectively prevents unwanted foam build-up here.

Product Recommendations Non-Aqueous Applications

In vacuum distillation or visbreakers, we recommend a solution specially developed by us: SILFOAM® SD 986, a pre-diluted high-viscosity silicone fluid in a suitable solvent. In delayed cokers, the high efficiency and thus lower dosage requirements of WACKER® AK 600000 ensure that only a minimum of silicone is transferred to downstream processes. We recommend the use of low-viscosity silicone fluids for use in asphalt processing and transport.

Powerful Fuels and Lubricants

SILFOAM® antifoam products will ensure that you end up with powerful end products and a smooth-running application.

Engine Oils, Hydraulic Fluids, Transmission Oils and Cutting Fluids

These fluids and lubricants require low-viscosity silicone fluids. Aqueous cutting fluids can either use SILFOAM® antifoam emulsions or SILFOAM® antifoam compounds, depending on the type of oil they contain.

Biological Wastewater Treatment

Most companies that produce or process products for the petroleum industry operate their own industrial wastewater treatment plants. SILFOAM® antifoam emulsions are ideally suited for use in all aerobic and anaerobic process stages to effectively prevent unwanted foam build-up.

Product Recommendations

Engine Oils, Hydraulic Fluids, Transmission Oils

For these fluids, WACKER® AK silicone fluids will provide you the right degree of foam inhibition. In addition to the viscosity range listed in the table, we also offer products with a viscosity specially tailored to your needs.

Cutting Fluids (coolants)

For non-aqueous cutting fluids, a few ppm of WACKER® AK 60000 is enough for effective foam control. Aqueous cutting fluids can either use SILFOAM® antifoam emulsions or SILFOAM® antifoam compounds, depending on the type of oil they contain.

Biological Wastewater Treatment

To operate at optimum capacity, wastewater treatment plants need efficient foam control. For this purpose, we recommend our antifoam emulsions SILFOAM® SE 24 and SILFOAM® SE 2210



SILFOAM® | DISPERSION | SPECIALIZATION & PROCESS INDUSTRY

SILFOAM® STRIKES BALANCE BETWEEN SPECIALIZATION & PROCESS DIVERSITY

Highly specialized products for diverse industrial applications are the basis of economical dispersions manufacture. SILFOAM® sets the tone in dispersion defoaming.

As valuable process aids, our SILFOAM® products combat and suppress bothersome foam formed as a result of stirring the dispersion and thereby introducing shearing forces, of removing residual monomers from the dispersion, of transferring the dispersion to downstream processing facilities or of filling it into merchandising containers.

As quality aids, SILFOAM® foam-control agents optimize the processing and use of dispersion-based products. Their ability to deaerate microfoams and their good compatibility with organic systems make SILFOAM® products particularly valuable for use in processing and modifying dispersions. In sensitive applications in the paints and surface coatings or paper sectors, too, SILFOAM® grades provide essential properties such as optimized flow and the formation of immaculate surfaces.

Emulsions, organically modified compounds or organofunctional self-dispersing silicone antifoam agents? No matter which of these you use, WACKER has the right SILFOAM® foam-control agent. Our broad product portfolio is fine tuned to meet every requirement so you can be sure of high levels of efficiency and compatibility.

Advantages

- Outstanding performance in almost all surfactant and protective colloid systems

- Good compatibility, enabling use also in sensitive applications such as paints and surface coatings
- Highly dispersible and shear-stable
- Do not cause loss of gloss in polymer films, and are therefore ideal for formulating high-gloss lacquers

Legal Requirements

Our product range also includes antifoam agents for applications that must satisfy special food-contact regulations.

The following products comply with the US Food and Drug Administration (FDA), the German Institute for Risk Assessment (BfR) or the EU Plastics Implementation Measure (PIM):

- SILFOAM® SC 370 BfR XIV, XV and XXXVI, Plastics Implementation Measure (PIM) (EU)No. 10/2011 (replaces Plastics Regulation (2002/72/EC)
- SILFOAM® SC 385 BfR XIV and XXXVI, FDA 21 CFR §175.105, 176.170, 176.180, 176.200 and 176.210
- SILFOAM® SE 21 FDA 21 CFR § 175.105, 175.300, 176.170, 176.180, 176.200 and 176.210.

Product Recommendations

Dispersion Production

Our medium-to-fine particle o/w emulsions SILFOAM® SE 21 and SILFOAM® SE 23 or our self-dispersing SILFOAM® SD 670 silicone antifoam agent are ideal for this application. Particularly in systems subjected to high shear forces or with a high surfactant content, SILFOAM® SD 670 is superior to organic defoamers. The organically modified compounds

SILFOAM® SC 370 and SILFOAM® SC 385 are first choice for applications subject to food safety regulations.

Dispersion-Based Products

Our polyether-functional compound SILFOAM® SC 370 or self-dispersing compounds SILFOAM® SD 860 and SILFOAM® SD 882 are particularly suitable for this field of application. SILFOAM® SD 860 has proved ideal in high-solids systems.

Sensitive Applications

WACKER has developed the organically modified defoamers SILFOAM® SD 670 and SILFOAM® SD 882 specifically for this purpose. Particularly in SILFOAM® SD 882, the typical silicone properties have been attenuated by a high level of organic modification.



Dispersion SILFOAM®	Application	Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
SE 21	S-PVC, interior paints, exterior paints	17	10	3,000	4.3	Non-ionic	Emulsion
SE 23	S-PVC, interior paints, exterior paints	40	30	5,000	4.3	Non-ionic	Emulsion
SE 3210	S-PVC, interior paints, exterior paints	30	20	1,500	8.0	Non-ionic	Emulsion
SE 24	S-PVC, interior paints, exterior paints	16	10	3,000	7.2	Non-ionic	Emulsion
SD 670	Printing inks, paper coatings, adhesives, construction materials	100	100	150	-	-	Self-dispersing
SD 860	Printing inks, high-gloss lacquers, adhe- sives, construction materials	100	100	100	-	-	Self-dispersing
SD 882	Paper coating, interior paints, exterior paints	100	100	20	-	-	Self-dispersing
SC 370	Interior paints, high-gloss lacquers	100	100	650	-	-	Compound
SC 385	Interior paints, high-gloss lacquers, con- struction materials	100	100	300	-	-	Compound



SILFOAM® | GENERAL INDUSTRIAL | DIVERSITY

SILFOAM® STRIKES BALANCE BETWEEN VERSATILITY & PROCESS DIVERSITY

Optimize almost any of your general industrial processes. SILFOAM® antifoam products control and regulate undesirable foaming in a very wide array of industrial processes.

Our foam-control systems show their true strengths not only through universality and compatibility, but also in their effectiveness, diversity, versatility across many industrial processes. Any process that employs moving, mixing, blending, shearing, agitating, swirling, pumping of liquids can and will produce foaming conditions.

As the foam builds it will directly impact any of these processes by limiting throughput, contamination, chemical treatment effectiveness, and so on. The right SILFOAM® product will eliminate the foam issue and return your process to its original state.

General Industrial		Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
SILFOAM®	Application						
SC 132	Defoamer formulations for distillation, glycol scrubbing (Antifreeze Systems), resin manufacturing & polymerization, adhesive working fluids, industrial cleaning, and other general industries	100	100	20,000	-	-	Compound
SC 200	Defoamer formulations for distillation, glycol scrubbing (Antifreeze Systems), resin manufacturing & polymerization, adhesive working fluids, metal working fluids, industrial cleaning, and other general industries	100	100	4,000	-	-	Compound
SC 203	Defoamer formulations for distillation, glycol scrubbing (antifreeze systems), adhesive working fluids, metal working fluids, fermentation, and other general industries	100	100	2,500	-	-	Compound
SE 55 A	Defoamer for metal working fluids, industrial cleaning, chemical processing, and other general industries	50	40	1,650	8.5	Non-ionic	Emulsion
SRE	Defoamer for distillation, glycol scrubbing (antifreeze systems), construction materials, paper coatings, industrial cleaning, chemical processing, and other general industries	33	20	150	7.0	Non-ionic	Emulsion
SE 21	Defoamer for paper coatings, metal working fluids, industrial cleaning, chemical processing, fermentation, and other general industries	17	10	3,000	4.3	Non-ionic	Emulsion
SE 23	Defoamer for paper coatings, metal working fluids, industrial cleaning, chemical processing, fermentation, and other general industries	40	30	5,000	4.3	Non-ionic	Emulsion
SE 1210	Defoamer for distillation, glycol scrubbing (antifreeze systems), construction materials, paper coatings, casting slurries, electronics, metal working fluids, industrial cleaning, and other general industries	10	6	700	8.0	Non-ionic	Emulsion

General Industrial		Solids content, approx. [%]	Actives content, approx. [%]	Viscosity approx. [mPa s], 25 °C	pH approx.	Ionic character	Product type
SILFOAM®	Application						
SE 2210	Defoamer for distillation, glycol scrubbing (antifreeze systems), construction materials, paper coatings, casting slurries, electronics, metal working fluids, industrial cleaning, and other general industries	20	13	700	8.0	Non-ionic	Emulsion
SE 3210	Defoamer for distillation, glycol scrubbing (antifreeze systems), construction materials, paper coatings, casting slurries, metal working fluids, industrial cleaning, and other general industries	30	20	1,500	8.0	Non-ionic	Emulsion
SE 24	Defoamer for distillation, glycol scrubbing (antifreeze systems), construction materials, paper coatings, metal working fluids, industrial cleaning, and other general industries	16	10	3,000	7.2	Non-ionic	Emulsion
SD 670	Defoamer for metal working fluids, industrial cleaning, and other general industries	100	100	150	-	-	Self-dispersing
SD 860	Defoamer for distillation, glycol scrubbing (antifreeze systems), metal working fluids, industrial cleaning, chemical processing, and other general industries	100	100	100	-	-	Self-dispersing
SD 882	Defoamer for metal working fluids, industrial cleaning, and other general industries	100	100	20	-	-	Self-dispersing
SC 370	Defoamer for ceramics, metal working fluids, industrial cleaning, and other general industries	100	100	650	-	-	Compound
SC 385	Defoamer for metal working fluids, industrial cleaning, and other general industries	100	100	300	-	-	Compound



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