PRODUCT OVERVIEW 101

SIPERNAT®

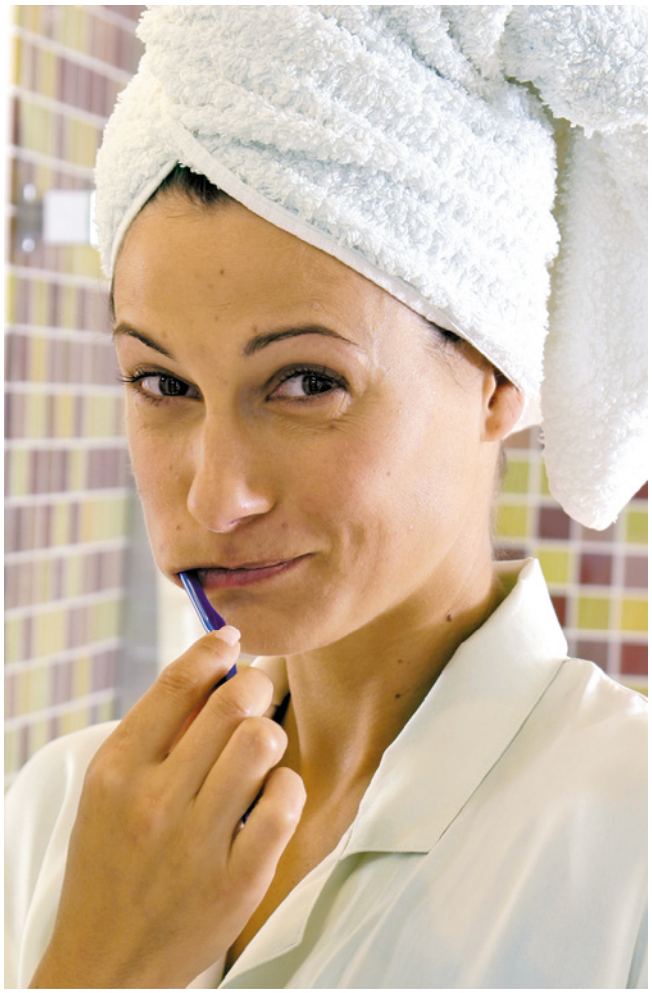
Specialty Silica

EVONIK
POWER TO CREATE

EVERY DAY, WHEREVER WE LOOK …

… and in virtually everything we do, we find products that would be unthinkable without specialty silica from Evonik.

- At the breakfast table, SIPERNAT® ensures that cappuccino powder, salt and spices flow freely and keeps them from caking.
- And when you pick up the newspaper, the crisp print quality is due to a special filler for the paper – that's how SIPERNAT® makes for better reading.
- SIPERNAT® also improves the quality of exterior and emulsion paints in terms of coverage as well as resistance to abrasion and exposure.
- Plant protection products contain SIPERNAT® to make dosage easier …
- … likewise, as a carrier medium for vitamins, SIPERNAT® facilitates dosing feed additives for livestock as well.



- SIPERNAT® makes sure that the powder in fire extinguishers stays effective, even when they have been unattended for a long time.
- You will also find SIPERNAT® in the separator sheets of your car battery, contributing to an always powerful start.
- You will find specialty silica in the office, too: If your inkjet printouts look as crisp and brilliant as the original on screen, it's because the printer paper probably has been coated with SIPERNAT®.
- Good thing the silicone used for the keypad on your mobile phone is reinforced with SIPERNAT® to keep it soft to the touch and extremely durable.
- SIPERNAT® keeps the thin film of plastic bags, e.g. for fruit and vegetables, from clinging together.
- ... and to keep suds from building up too much when you do the laundry, SIPERNAT®-based antifoam is added to detergents.

With its extensive know-how and long experience in manufacturing specialty silica, Evonik makes an essential contribution to improving the products we use as consumers - for a better quality of life, day after day.

1. INDUSTRIES AND FUNCTIONS

1.1 Industries

Specialty silica, providing benefits to our customers every day and everywhere.

Silica is one of the most flexible active ingredients for a variety of applications. Silica can be designed and tailored to a wide range of applications.

As a leading global producer of specialty silica, we are well represented around the globe with sales offices, technical centers and production sites. We also bring more than 50 years' experience in research, development and manufacturing to the table for customized solutions involving specialty silica. All of this enables us to offer a wide range of innovative products and services. Our efforts to consistently understand and address the needs of our customers and their markets drive our success and strengthen our ability to innovate.

SIPERNAT® benefits a wide variety of industries (see 1.3.):

- Chemical industry
- Rubber additives
- Fire extinguishers
- Superabsorbents
- Defoamer/antifoam agents
- Printing inks
- Paints and coatings
- Feed additives
- Personal care
- Plastics industry
- Food supplements
- Paper products
- Newsprint
- Inkjet coating
- Thermal paper
- Plant protection
- Pharmaceutical industry
- Polyester resins (unsaturated)
- Silicone rubber
- Detergent additives

1.2 Functions

The key functions (see 1.4) of SIPERNAT® deliver significant functional improvements, including:

- Adhesion
- Antiblocking
- Agglomeration
- Controlled release
- Carrier substances
- Flow improvement
- Improvement in printing properties
- Mechanical interaction
- Several special functions in thermoplastics
- Surface effects
- Reinforcement
- Rheology control
- Whitening

SIPERNAT® is an innovative choice for anyone looking for improvements in performance.

7:00 AM

Plant protection products contain SIPERNAT® to make dosage easier …

1.3 Industries and Products

APPLICATION / INDUSTRY	FUNCTION / EFFECT	RECOMMENDED PRODUCTS		AMOUNT TO ADD	METHOD OF INCORPORATION
CHEMICAL INDUSTRY					
Rubber and plastic additives Powder defoamer	convert liquid additives into powder	SIPERNAT® 22 SIPERNAT® 33	SIPERNAT® 50 SIPERNAT® 2200	25–50 %	low-shear mixer / free-fall mixer
Plastic powders	improve flowability	SIPERNAT® D 17 SIPERNAT® D 10	SIPERNAT® 22 S SIPERNAT® 622 S	0.1–2 %	medium-shear mixer
	reduce electrostatic charging	SIPERNAT® 820 A		0.1–2 %	medium-shear mixer
	anticaking of pre-foamed polystyrene granules	SIPERNAT® D 17		0.1–0.3 %	free-fall mixer
Fire extinguishing powder	improve storage stability and flowability	SIPERNAT® D 17 SIPERNAT® D 10		0.5–1.5 %	medium-shear mixer
Other chemical intermediates in powder form	improve storage stability and flowability	SIPERNAT® 22 S SIPERNAT® 22 LS SIPERNAT® 50 S SIPERNAT® 622 S SIPERNAT® 500 LS SIPERNAT® 320 SIPERNAT® 320 DS	SIPERNAT® 820 A SIPERNAT® 880 SIPERNAT® D 10 SIPERNAT® D 13 SIPERNAT® D 17 SIPERNAT® 622 LS	0.1–2 %	medium-shear mixer
Redispersible polymer powders	improve storage stability and flowability	SIPERNAT® 22 S SIPERNAT® 622 S SIPERNAT® D 17	SIPERNAT® D 13	1–3 %	in spray dryer
Catalysis	catalyst carrier/binder	SIPERNAT® 306* SIPERNAT® 310 SIPERNAT® 50		depending on catalyst formula	medium-shear mixer
	raw materials for zeolite synthesis	SIPERNAT® 320		depen-ding on zeolite formula	medium-shear mixer
Defoamer / antifoam	Rapid foam destruction (knock-down)	SIPERNAT® 320 DS SIPERNAT® 383 DS SIPERNAT® 35* SIPERNAT® 22 S SIPERNAT® D 10 SIPERNAT® D 13 SIPERNAT® D 17	Carrier for powder defoamer: SIPERNAT® 22 SIPERNAT® 33 SIPERNAT® 2200 SIPERNAT® 50	3–10 %	high-performance stirrer, rotor stator unit

Recommended literature

Industry Information II 2241 – AEROSIL® and SIPERNAT® products for optimized crop protection formulations
Industry Information II 2242: Inorganic Materials for Catalyst Innovation
Technical Information TI 1243: AEROXIDE®, AERODISP® and AEROPERL® Titanium Dioxide as Photocatalysts
Technical Information TI 1313: SIPERNAT® and AEROSIL® for Defoamer
Technical Information TI 1381: AEROSIL® and SIPERNAT® - Efficient booster for defoamer in paints and coatings
Technical Information TI 1382: Comparison of SIPERNAT® D10 with in-situ hydrophobized fumed silica
Technical Information TI 1391: Improving Sedimentation Stability of SIPERNAT® D 10 in Mineral Oil based Defoamer Formulations
Technical Information TI 1413: SIPERNAT® specialty silica and AEROSIL® fumed silica for fire extinguishing powders

SILICONE RUBBER					
HTV silicone rubber	active filler with reinforcing properties	SIPERNAT® D 17 SIPERNAT® 160 SIPERNAT® 236*	SIPERNAT® 268* SIPERNAT® 288* SIPERNAT® 298*	30–50 phr	addition during compounding on a roll mill or internal mixer
Liquid silicone rubber	active filler with reinforcing properties	SIPERNAT® D 17 SIPERNAT® 160	SIPERNAT® 120 SIPERNAT® 320 DS	20–30 %	addition during compounding

Recommended literature

Industry Information II 2247: Materials for the Silicone Rubber Industry
Technical Information TI 1246: SIPERNAT® specialty silica for high temperature vulcanized silicone rubber

* Regionally restricted availability

1.3 Industries and Products

APPLICATION/ INDUSTRY	FUNCTION/ EFFECT	RECOMMENDED PRODUCTS	AMOUNT TO ADD	METHOD OF INCORPORATION
PLASTICS				
Polyethylene	IR reflection (greenhouse films)	SIPERNAT® 820 A SIPERNAT® 22 S SIPERNAT® 22 LS SIPERNAT® 622 LS	3–7 %	via masterbatch or direct extrusion
Polyethylene	Antiblocking agent in blow-molded films	SIPERNAT® 44 MS** SIPERNAT® 310 SIPERNAT® 880 SIPERNAT® FPS-5*	0.1–0.2 %	via masterbatch with about 10–20 % loading
Polyethylene	pore creator in battery separators (incl. paper separators)	SIPERNAT® 325 C SIPERNAT® 22 S SIPERNAT® BG-2* SIPERNAT® 325 AP*	50–60 %	pre-mix with approx. 25–30 % silica; after extrusion and extraction approx. 50–60 %
Polyethylene	Antiblocking agent in blow-molded films and cast films	SIPERNAT® 350 SIPERNAT® 44 MS** SIPERNAT® 310 SIPERNAT® 880 SIPERNAT® FPS-5*	0.1–0.2 %	premixing in PP powder, via master-batch, via additive concentrate
Polyester (PET)	Antiblocking	SIPERNAT® 500 LS	1 %	addition during polycondensation
Polystyrene	Nucleate foam bubbles and structure	SIPERNAT® 320 DS	0.1–0.5 %	addition during mixing of components (add silica first)
Polyvinyl chloride (PVC)	prevents plate-out during extrusion	SIPERNAT® 320 DS SIPERNAT® 500 LS	0.5–1.5 %	addition during mixing
Polyvinyl chloride (PVC)	Antiblocking agent in films	SIPERNAT® 310	0.5–1.5 %	addition during mixing
Polyvinyl chloride (PVC)	improve hardness and scratch-resistance of floor coverings	SIPERNAT® 320 SIPERNAT® 880	5–30 %	addition together with mixing components before plasticizing
Polychloroprene	auxiliary in adhesives	SIPERNAT® 320 DS SIPERNAT® 50 S SIPERNAT® 880	8–12 %	mixing into the rubber in a roll mill or kneading apparatus
Thermoplastic rubber (TR)	Improve abrasion resistance, heat distortion resistance of TR crepe soles	SIPERNAT® 320 SIPERNAT® 22 SIPERNAT® 360	5–10 %	incorporation by kneading with internal mixers
Polysulfide sealants	active ingredient	SIPERNAT® D 10 SIPERNAT® D 17	5–10 %	planetary mixers, planetary dissolvers, dissolvers
Unsaturated polyester (Gel coat)	thixotropy/viscosity control	SIPERNAT® 22 LS SIPERNAT® 622 LS SIPERNAT® FPS-5*	2–4 %	high-speed mixer

Recommended literature
Technical Information TI 1206: Antiblocking Agent SIPERNAT
Technical Bulletin Pigments No. 63: Synthetic Silica for Sealants
Flyer – Avoiding porosity in gel coatings with SIPERNAT® 22 LS
Technical Information TI 1334: SIPERNAT® 820 A as an IR Absorber in Greenhouse Films

* Regionally restricted availability ** non-amorphous silicate

1.3 Industries and Products

APPLICATION / INDUSTRY	FUNCTION / EFFECT	RECOMMENDED PRODUCTS	AMOUNT TO ADD	METHOD OF INCORPORATION
PAINTS AND COATINGS				
Paints and coatings	partial substitution of titanium dioxide, other white pigments and extenders in emulsion paints	SIPERNAT® 820 A	up to 50% based on titanium dioxide, but not more than 5% in the overall formulation	dissolvers
	partial substitution of titanium dioxide in decorating paints and as matting agents for silk-gloss systems	SIPERNAT® 820 A	approx. 6% of overall formulation, up to 15% for silk-gloss paint	premixing in a stirrer, dispersion in a bead mill, ball mill or sand mill
Printing inks	Extenders to increase thixotropy and dot definition	SIPERNAT® 820 A	up to 5%	use in concentrate form (stock pastes); pre-dispersion with dissolver, final dispersion with ball mill or triple roll mill
	Reduced misting of offset printing inks	SIPERNAT® 320 DS SIPERNAT® 22 S SIPERNAT® 820 A	2–5 %	addition to the grind base; subsequent dispersion with dissolver and then grinding with ball mill
PAPER INDUSTRY				
Decorative papers	Extender for TiO_2	SIPERNAT® 820 A	10–30 % based on titanium oxide content	dissolvers
Inkjet coating	absorbency, resolution, color gamut	SIPERNAT® 310	55–80 % based on coating color	preparation of a suspension using dissolver
Thermal paper	heat insulation, resolution, dot definition	SIPERNAT® 350 SIPERNAT® 360 SIPERNAT® 101 M	5–30 % of the total amount of pigments (combination with $CaCO_3$)	preparation of a suspension using dissolver

Recommended literature

Technical Bulletin Pigments No. 34: SIPERNAT® 820A for emulsion decorative paints
Industry Information II 2243: Products for the paper and film industry

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… and it facilitates dosing of feed additives for livestock. Without SIPERNAT® breakfast would be less comfortable, because …

1.3 Industries and Products

APPLICATION / INDUSTRY	FUNCTION / EFFECT	RECOMMENDED PRODUCTS	AMOUNT TO ADD	METHOD OF INCORPORATION
CROP PROTECTION				
Wettable powers (WP) and water-dispersible granules (WG)	Carrier for active ingredients with fine grinding	SIPERNAT® 22 SIPERNAT® 320 SIPERNAT® 50 SIPERNAT® 22 S SIPERNAT® 622 S*	15–35 %	medium-shear mixer and mill
Wettable powers (WP) and water-dispersible granules (WG)	Carrier for active ingredients without fine grinding	SIPERNAT® 22 S SIPERNAT® 22 LS SIPERNAT® 50 S SIPERNAT® 622 S* SIPERNAT® 622 LS SIPERNAT® 500 LS SIPERNAT® 320 DS SIPERNAT® 350	15–35 %	medium-shear mixer
Wettable powers (WP) and water-dispersible granules (WG)	Granulation aid (WG)	SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 622 S* SIPERNAT® 22 LS SIPERNAT® 500 LS	15–35 %	medium-shear mixer
Wettable powers (WP) and water-dispersible granules (WG)	Carrier for acid-sensitive ingredients	SIPERNAT® 350 SIPERNAT® 360 SIPERNAT® 880	20–40 %	medium-shear mixer
Wettable powers (WP) and water-dispersible granules (WG)	Grinding aid for low-melting ingredients	SIPERNAT® 22 SIPERNAT® 22 S SIPERNAT® 622 S SIPERNAT® 50 SIPERNAT® 50 S SIPERNAT® 350	up to 10 %	free-fall mixer prior to grinding
Wettable powers (WP) and water-dispersible granules (WG)	Stabilization of ingredients/ controlled release, e.g. seed coating	SIPERNAT® D 17	1–10 %	low-shear mixer / granulation plate
Recommended literature Industry Information II 2241: AEROSIL® and SIPERNAT® products for optimized crop protection formulations Technical Information TI 1406: Seed treatment with SIPERNAT® specialty silica and AEROSIL® fumed silica				
PERSONAL CARE				
	carrier/absorbent	SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 500 LS	5–15 % 20–40 %	low/ medium-shear mixer
	rheology additive/ heat stabilization	SIPERNAT® 500 LS SIPERNAT® 22 LS	3–10 %	high-shear mixer
	cleaning effect / peeling effect	SIPERNAT® 22 PC SIPERNAT® 2200 PC	5–15 %	low/medium-shear mixer
	sensory / matting / optical wrinkle reduction in powder	SIPERNAT® 11 PC	5–15 %	use of low-shear and high-shear shear mixers possible
	sensory / matting in emulsions and gels	SIPERNAT® 11 PC	2–5 %	use of low-shear and high-shear shear mixers possible
Recommended literature Technical Information TI 1394: Powder to Cream - An innovative concept for cosmetic formulations in powder form Technical Information TI 1251: AEROSIL® and SIPERNAT® Silica: Versatile Raw materials for Personal Care formulations Industry Information II: AEROSIL® and SIPERNAT® Silica for Personal Care				

1.3 Industries and Products

APPLICATION/ INDUSTRY	FUNCTION/ EFFECT	RECOMMENDED PRODUCTS	AMOUNT TO ADD	METHOD OF INCORPORATION
DETERGENTS AND CLEANING PRODUCTS				
	carrier/ anticaking/ improved flowability	SIPERNAT® 50 S SIPERNAT® 22 S SIPERNAT® 340 SIPERNAT® 2200	1–3 %	low-shear mixer/free-fall mixer
Recommended literature Industry Information II 2246: AEROSIL® fumed silica and SIPERNAT® specialty silica for detergents and cleaning products				
FEED INDUSTRY				
Vitamin-E acetate	convert into powder form	SIPERNAT® 22 SIPERNAT® 2200 SIPERNAT® 680*	approx. 50 %	use a low-shear mixer, introduce the silica first and then spray the liquid vitamin onto the silica while the mixer is running
Choline chloride	convert 75% aqueous choline chloride solution to stable 50% powder form, improve flowability	SIPERNAT® 22 SIPERNAT® D 17	33 % 0,1–0,3 %	use a low-shear mixer, introduce carrier silica first and then spray the solution onto the silica while the mixer is running; finally, addition of SIPERNAT® D 17 to improve flowability
Vitamin premixes	anticaking, improve flowability	SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 622 S* SIPERNAT® D 17	0,5–2 % 0,1–0,5 %	low-shear mixer/free-fall mixer
Other liquid additives, e.g. acids, antioxidants, pigments	convert into powder form	SIPERNAT® 22 SIPERNAT® 2200 SIPERNAT® 50	approx. 33 % approx. 35 % approx. 25 %	use a low-shear mixer, introduce the carrier silica first and then spray the liquid onto the silica while the mixer is running
Fish feed	increase fat or oil content in fish feed	SIPERNAT® 22 SIPERNAT® 50	1–4 %	addition of silica to pelletizing mixture with extra fat
Milk replacer fat concentrates	anticaking, improve flowability	SIPERNAT® 22 SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 622 S*	0,2–1,5 %	addition of silica to a spray dryer (SIPERNAT® 22, SIPERNAT® 22 S, SIPERNAT® 50 S) or to the final product (SIPERNAT® 22 S, SIPERNAT® 50 S) in a low-shear mixer
Recommended literature Technical Information TI 1213: Silica Flow Agent and as Carrier-Suitable Mixing Processes for Powders and Granulates Industry Information II 2127: SIPERNAT® in the Animal Feed Industry Technical Information TI 1351: SIPERNAT® specialty silica and AEROSIL® fumed silica as a Flow Aid and Anticaking Agent				

*Regionally restricted availability

Without SIPERNAT® breakfast would be much less comfortable because …

8:00 AM

… SIPERNAT® keeps my cappuccino powder from coming out in lumps …

1.3 Industries and Products

ANWENDUNG/ INDUSTRIE	FUNCTION/ EFFECT	RECOMMENDED PRODUCTS	AMOUNT TO ADD	METHOD OF INCORPORATION
FEED INDUSTRY				
Whey powders	anticaking, improve flowability	SIPERNAT® 22 SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 622 S*	0.5–2 %	addition of the silica into a spray dryer (SIPERNAT® 22, SIPERNAT® 22 S, SIPERNAT® 50 S) or to the final product (SIPERNAT® 22 S, SIPERNAT® 50 S) in a low-shear mixer
Feed urea	anticaking, improve flowability	SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 622 S*	1–3 %	medium-shear mixer
Mineral premixes	anticaking, improve flowability	SIPERNAT® D 17	0.1–0.5 %	medium-shear mixer
		SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 622 S*	0.5–1.5 %	
Other powdered feed ingredients	anticaking, improve flowability	SIPERNAT® 22 S SIPERNAT® 50 S	0.5–2 %	medium-shear mixer
FOOD INDUSTRY				
Brewing process	clarifying agent and absorbent	SIPERNAT® 303* SIPERNAT® 306*	30–50 g/hl	added to the filtration step together with diatomaceous earth
Coffee creamer	anticaking, improve flowability	SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 680*	1 %	low-shear mixer/ free-fall mixer
Table salt, sugar/icing sugar	anticaking, improve flowability	SIPERNAT® 22 S SIPERNAT® 50 S	0.2–1 %	medium-shear mixer/ free-fall mixer
Spice mixtures	anticaking, improve flowability	SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 350	3 %	low-shear mixer/ free-fall mixer
Other food ingredients, e.g. soup powder, garlic powder, fruit powders, instant drink powders	anticaking, improve flowability	SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 350	0.2–1 %	low-shear mixer/free-fall mixer

Recommended literature

Technical Information TI 1213: Silica Flow Agent and as Carrier-Suitable Mixing Processes for Powders and Granulates
Industry Information II 2129: SIPERNAT® and AEROSIL® for the Food Industry
Technical Information TI 1351: SIPERNAT® and AEROSIL® as Flow Aid and Anticaking Agent
Industry Information II 2124: SIPERNAT® and AEROSIL® for the Salt Industry
Technical Information TI 1386: AEROSIL® and SIPERNAT® for free flowing and non-caking sugars and sugar alcohols
Technical Information TI 1364: AEROSIL® and SIPERNAT® for spices and seasonings
Technical Information TI 1356: SIPERNAT® and AEROSIL® in Powdered Drinks
Technical Information 1351 - SIPERNAT® specialty silica specialty silica und AEROSIL® fumed silica as flow aid and anticaking agent

* Regionally restricted availability

1.4 Functions and Products

KEY FUNCTION / EFFECT	FUNCTION / EFFECT	APPLICATION / INDUSTRY	SPECIALTY SILICA	
Adhesion	auxiliary in adhesives	polychloroprene	SIPERNAT® 320 DS SIPERNAT® 50 S	SIPERNAT® 880
Antiblocking	prevents clinging of films	polyethylene, polypropylene polyester, polyvinyl chloride films	SIPERNAT® 44 MS** SIPERNAT® 310 SIPERNAT® 350	SIPERNAT® 500 LS SIPERNAT® FPS-5
Agglomeration	granulation aid	plant protection (water-dispersible granules)	SIPERNAT® 22 S SIPERNAT® 50 S SIPERNAT® 22 LS SIPERNAT® 622 LS	SIPERNAT® 500 LS SIPERNAT® 320 DS SIPERNAT® 350
Controlled release	stabilize active ingredients, e.g. seed coating	plant protection	SIPERNAT® D 17	
Carrier	convert liquid additives into powder	rubber and plastic additives, feed additives, powder defoamers, plant protection and dry liquids	SIPERNAT® 22 SIPERNAT® 50 SIPERNAT® 320 SIPERNAT® 33	SIPERNAT® 2200 SIPERNAT® 350 SIPERNAT® 360 SIPERNAT® 880
Catalyst carrier/ catalyst raw material	carrier	catalysts	SIPERNAT® 306* SIPERNAT® 310	SIPERNAT® 50
	binders	extrudates	SIPERNAT® 306* SIPERNAT® 310	SIPERNAT® 50
	raw material	zeolites	SIPERNAT® 320	
Flow aid	improve flowability	construction chemicals, redispersible polymer powders, rubber recycling powders	SIPERNAT® 22 S SIPERNAT® 22 LS SIPERNAT® 25* SIPERNAT® 50 S SIPERNAT® 622 LS SIPERNAT® 500 LS	SIPERNAT® 320 SIPERNAT® 320 DS SIPERNAT® 880 SIPERNAT® D 10 SIPERNAT® D 13 SIPERNAT® D 17
	anticaking	powdery feed ingredients, vitamin premixes, mineral premixes, powdery food ingredients	SIPERNAT® D 17 SIPERNAT® 22	SIPERNAT® 22 S SIPERNAT® 50 S
	improve storage stability (moisture-sensitive products)	fire extinguishing powders, construction chemicals, redispersible polymer powders, rubber recycling powders, other chemical intermediates in powder form	SIPERNAT® D 10	SIPERNAT® D 13* SIPERNAT® D 17
Improvement in printing properties	reduce misting dots	offset inks	SIPERNAT® 320 DS SIPERNAT® 22 S	SIPERNAT® 820 A
	enhance contrast	Diazo papers	SIPERNAT® 320 DS	
	enhanced halftone printing and color intensity	inkjet paper coating (matt)	SIPERNAT® 310	
	optimized dot definition	thermal paper	SIPERNAT® 101 M	SIPERNAT® 350
Mechanical interaction	grinding aid	Plant protection	SIPERNAT® 22 SIPERNAT® 22 S SIPERNAT® 50	SIPERNAT® 50 S SIPERNAT® 320
Specialty functions in thermoplastics	pore creator in thermoplastic matrices	battery separator	SIPERNAT® 325 C SIPERNAT® 22 S	SIPERNAT® BG-2* SIPERNAT® 325 AP*
	IR reflection	Polyethylene films	SIPERNAT® 820 A SIPERNAT® 22 S	SIPERNAT® 22 LS
	reinforce form structure	Polystyrene	SIPERNAT® 320 DS	
	prevent plate-out	Polyvinyl chloride	SIPERNAT® 320 DS	SIPERNAT® 500 LS
Surface effects	rapid foam destruction (knock-down)	» defoamer » antifoams	SIPERNAT® 320 DS SIPERNAT® 383 DS SIPERNAT® 35* SIPERNAT® 50 S	SIPERNAT® D 10 SIPERNAT® D 13* SIPERNAT® D 17
	clarifying agent and absorbent	brewing process	SIPERNAT® 303*	SIPERNAT® 306*
	reduce electrostatic charging	plastic powders	SIPERNAT® 820 A	

* Regionally restricted availability ** non-amorphous silicate

1.4 Functions and Products

KEY FUNCTION / EFFECT	FUNCTION / EFFECT	APPLICATION / INDUSTRY	SPECIALTY SILICA	
Reinforcement	reinforcing filler	silicone rubber	SIPERNAT® D 17 SIPERNAT® 120 SIPERNAT® 160 SIPERNAT® 288*	SIPERNAT® 268* SIPERNAT® 298* SIPERNAT® 236*
	scratch resistance of floor coverings	polyvinyl chloride	SIPERNAT® 320	SIPERNAT® 500 LS SIPERNAT® FPS-5
Rheology	thixotropy/ viscosity control	unsaturated polyester resin	SIPERNAT® 22 LS SIPERNAT® 622 LS	
		RTV-2C/LSR silicone rubber	SIPERNAT® 320 DS	
	extender to increase thixotropy	printing inks	SIPERNAT® 820 A	
Whitening	partial substitution of titanium dioxide	paints and coatings laminates in decorative paint	SIPERNAT® 820 A	

2. PRODUCTS

2.1 Product Description

HYDROPHILIC SILICA

SIPERNAT® 11 PC

SIPERNAT® 11 PC has been developed especially for the replacement of micro-plastics in moisturizing and tinting creams, foundations, makeup and face powder. SIPERNAT® 11 PC improves the sensory feel and results in a better, more refined skin feel.

SIPERNAT® 22

A silica that combines high absorption capacity with good flowability. It is our basic recommendation as a carrier silica for converting liquids into free-flowing powders.

Examples can be found in the feed industry, where SIPERNAT® 22 is used as a carrier silica for choline chloride solutions, vitamin E acetate, and other liquid active substances. In crop protection formulations, this silica is used as a grinding aid for low-melting active substances and, in case of further grinding, as a carrier for liquids.

SIPERNAT® 22 LS

As a finely ground silica with a high absorption capacity for liquids, SIPERNAT® 22 LS is frequently used as a thickener for liquid systems, e.g. thixotropy/viscosity adjustment in unsaturated polyester gel coats. In fine powders, it reduces caking and improves flowability.

SIPERNAT® 22 S

A silica with high absorption capacity used as a flow and anti-caking agent in many applications as well as special-purpose ingredient for mechanical graphics papers.

In plant protection, this product is recommended as a carrier in solid formulations such as wettable powders (WP) and water-dispersible granules (WG) if grinding is to be avoided.

SIPERNAT® 22 PC

SIPERNAT® 22 PC is an environmentally friendly solution to replace PE components in peeling products such as shower gels. In addition to its cleaning effect, the product can also serve as a carrier for liquid ingredients in cosmetic formulations due to its sponge-like structure.

SIPERNAT® 25*

This ultrapure fine-particle silica is used as a flow aid and anti-caking agent in powdered food ingredients. SIPERNAT® 25 meets the requirements of Japanese food regulations.

SIPERNAT® 33

SIPERNAT® 33 is a silica with predominantly spherical particles, low fines content and very high oil absorption (DOA = dioctyl adipate method). It combines a very high absorption capacity for liquids with high bulk density and very good flow properties.

Typical applications include:

- carrier for rubber additives, e.g. melamine resins
- carrier for plastics additives
- carrier for resins, e.g. in powder coatings
- carrier for powder defoamers

SIPERNAT® 35*

A very finely milled, hydrophilic, slightly alkaline silica, which is particularly well-suited for producing in-situ hydrophobized defoamers and provides homogeneous results. It is not necessary to add any other catalyst.

SIPERNAT® 622 LS*

With high absorption capacity for liquids, this finely ground silica is often used as a thickener in liquid systems. Reduction of caking and flowability improvement of fine powders can also be achieved with this silica grade.

SIPERNAT® 50

As a carrier silica with particularly high absorbency, this product has the capacity to convert liquid active substances or solutions into powders. Concentrates of up to 75% can be produced using SIPERNAT® 50. It is also used as a grinding aid for fatty products. Typical applications include:

- rubber and plastics additives
- plant protection formulations
- feed additives

SIPERNAT® 50 S

Silica with particularly high absorption capacity enhances flowability and prolongs the shelf life of powdered substances which are liable to caking, especially those with high fat content. SIPERNAT® 50 S also acts as a high absorbency carrier in cases where particle fineness is needed in addition to high concentration, e.g. in plant protection formulations such as WP and WG.

SIPERNAT® 101 M

As a very finely ground silica with medium surface area, moderate absorption capacity and high chemical purity, this grade helps to improve dot definition in thermal paper applications.

SIPERNAT® 120

This silica with medium particle size and moderate absorption capacity serves as a carrier for special applications and as a reinforcing filler HTV, LSR und RTV-2C silicone rubber applications, where it enhances mechanical strength and stabilizes viscosity.

SIPERNAT® 160

This silica combines high chemical purity, low drying loss and low water absorption. In HTV and LSR silicone droppers, it provides excellent reinforcing effects (tear resistance) and superior electrical properties. Using an alkaline catalyst for process optimization, this product is suited for the production of in-situ hydrophobized defoamers.

SIPERNAT® 303*

This grade is a finely ground silica with a high surface area. Due to his high filtration stability, it can be used as a clarifier and adsorbent in liquid, water-based systems, e.g. filtration and stabilization of beer.

8:30 AM

Vitamin tablets contain SIPERNAT® to improve dosage accuracy.

* Regionally restricted availability.

SIPERNAT® 306*

This grade is a silica with an optimized pore size distribution, making it an ideal fit for catalyst carrier applications. Due to his high filtration stability, SIPERNAT® 306 can be used as a clarifier and adsorbent in liquid, water-based systems, e.g. filtration and stabilization of beer.

SIPERNAT® 310

As a very finely ground silica with a very high surface area (BET), this grade is used, for instance, as an antiblocking agent in polyolefins and PVC. When the product is applied as a coating pigment for inkjet papers, it increases color density and enhances dot definition. It can also be used as a binder or carrier in heterogeneous catalysts.

SIPERNAT® 320

As a silica with a medium particle size and moderate absorption capacity, this grade offers significant advantages in numerous applications: e. g. as a carrier for liquids, flow agent for powders, as a grinding aid in plant protection formulations and also to boost scratch resistance in PVC floorings. Due to its great handling advantages, it is also applied as a raw material for high-silica zeolites.

SIPERNAT® 320 DS

This very finely ground silica is well suited for thickening liquids and makes an excellent flow aid. Typical applications include:

- all types of fine powders (flow improvement)
- defoamers/antifoams (rapid foam destruction after in-situ hydrophobization)
- adhesives (auxiliary ingredient)
- printing/offset inks (prevents misting and setoff, also used as an extender)
- RTV-2C-/LSR silicone rubber applications (viscosity adjustment)

SIPERNAT® 325 AP*

Coarse milled silica with neutral pH value, medium surface area and high oil absorption (DOA = dioctyl adipate method).

SIPERNAT® 325 C

This grade is a silica with medium particle size, medium absorption capacity and moderate surface area. It is used as a pore generator for PE battery separators.

SIPERNAT® 340

This is a medium-sized silica with high oil absorption (DOA = dioctyl adipate method). SIPERNAT® 340 is less dusty than small-particle flow agents, but shows good free flow improvement performance in powders.

SIPERNAT® 350

This grade's very finely ground size, medium absorbency and alkaline pH value constitute and interesting combination of physico-chemical properties. One special application of this silica is the coating of high-quality heat-sensitive papers. In plant protection, this product is particularly suited for acid-sensitive active ingredients in formulations such as WP and WG. Furthermore, the small particle size makes it very useful for ultrathin polymeric films. Although very fine, this grade does not add dust when used as flow aid or anticaking agent.

SIPERNAT® 360

This medium-particle silica, which has a slightly alkaline pH value, is used as a carrier in plant protection where such a pH value is required for acid-sensitive active ingredients.

SIPERNAT® 383 DS

A very finely ground silica with a slightly alkaline pH value, which is particularly well suited for the production of in-situ hydrophobized defoamers. Due to its optimal pH value of about 8, it facilitates, e.g. the hydrophobization process of defoamers without the need to add any catalysts.

SIPERNAT® 500 LS

This very finely ground silica with low drying loss and particularly high absorbency offers many functions for different applications such as:

- antiblocking agent in polyester
- anti-plate-out agent in plasticized PVC
- highly effective thickener in liquid systems
- highly effective flow aid and excellent anticaking agent for fine powders
- raw material for insulation systems

SIPERNAT® 2200

As a micro-granular silica with spherical particles, low fines content and high absorption capacity, SIPERNAT® 2200 is able to convert any kind of liquid into nearly dust-free powders with high bulk density and very good flow properties.

SIPERNAT® 2200 PC
As a silica with a particle size in the range of 320 µm and low fines content, SIPERNAT® 2200 PC is an environmentally friendly solution to replace PE components in peeling products such as shower gels.

SIPERNAT® BG-2*
Specially designed to perform as a pore creator in PE battery separators; micropores are essential for ionic migration in automotive batteries. This silica grade combines optimized particle size with high oil absorption capacity and very low chlorine content.

SIPERNAT® FPS-5
As an extremely finely ground silica, this SIPERNAT® grade was developed to adjust thixotropy/viscosity in unsaturated polyester resins (gel coats). This product generates excellent antiblocking properties in thin films. Its high purity makes it an ideal flow aid for food ingredients. It is also a suitable extender for offset printing ink. Due to its matting efficiency, SIPERNAT® FPS-5 is also useful for water-based printing inks.

SIPERNAT® FPS-1
This finely ground silica with a high absorption capacity is used as a free-flow agent, especially for powder coatings.

SIPERNAT® 680
SIPERNAT® 680 is a medium surface area silica with aggregates of medium size and high absorption capacity. The product is easy to handle and can be used as a flow aid and carrier silica.

SIPERNAT® 622 S*
SIPERNAT® 622 S is a fine particle silica with medium surface area and high oil absorption capacity (DOA = dioctyl adipate method) that can be used as a flow aid/anticaking agent.

SIPERNAT® 218
SIPERNAT® 218 is particularly well-suited for rubber applications, especially silicone rubber such as HTV silicone rubber. It is a finely milled silica with neutral pH value, a low surface area and a relatively small particle size. Its ultrahigh purity is achieved with selected raw materials.

SIPERNAT® 236
SIPERNAT® 236 is a finely milled synthetic silica with neutral pH value, relatively high surface area, medium particle size and ultrahigh purity based on selected raw materials.

SIPERNAT® 238
SIPERNAT® 238 is a precipitated specialty silica, which is particularly well-suited for rubber applications, especially silicone rubber. Careful adjustment of parameters such as surface area, particle size, oil absorption capacity or purity (conductivity) results in products with different properties.

SIPERNAT® 268
SIPERNAT® 268 is a finely milled silica with neutral pH value, relatively high surface area, medium particle size and ultrahigh purity based on selected raw materials. The use of SIPERNAT® 268 enables the production of semi-transparent silicone rubber products with excellent mechanical properties and low discoloration tendencies.

SIPERNAT® 288
SIPERNAT® 288 is particularly well-suited for rubber applications, especially silicone rubber e.g. HTV silicone rubber. Careful adjustment of parameters such as surface area, particle size, oil absorption capacity or purity (conductivity) results in products with different properties.

SIPERNAT® 298
SIPERNAT® 298 is a finely milled silica with neutral pH value, relatively high surface area, medium particle size and ultrahigh purity based on selected raw materials. The use of SIPERNAT® 298 enables the production of ultratransparent silicone rubber products with excellent mechanical properties and very low discoloration tendencies.

HYDROPHOBIC SILICAS

SIPERNAT® D 10

This milled silica is hydrophobic (i.e. not wettable by water) and offers high methanol wettability and low surface area. It is used in a wide range of defoamers due to his high effectiveness and ease of dispersion.

SIPERNAT® D 13

This product is a milled, hydrophobic (i.e. not wettable by water) silica with high methanol wettability and low surface area. It is used in a wide range of defoamers due to his high effectiveness and ease of dispersion.

SIPERNAT® D 17

This hydrophobic (not water-wettable) silica is primarily used as an anticaking agent, but also as a defoamer.

- Fire extinguishing powders (anticaking)
- Masking powder for chill casting
- Defoamer/antifoam manufacture (fast foam destruction)
- Chemicals (flowability, anticaking)
- HTV/ RTV-2C/ LSR silicone rubber (reinforcing filler)

SILICATES

SIPERNAT® 820A

A sodium aluminum silicate with a high level of whiteness and reduced coarse particles, which is highly recommended for partial substitution of white pigments in emulsion paints, as a matting agent for silk glossy paint systems and as an extender in printing inks.

SIPERNAT® 820A is also used as a special-purpose filler for mechanical graphics papers, as an extender for titanium dioxide in papermaking, and as a white pigment for coated papers. It has beneficial effects on reducing possible ink bleeding, paper printability, smoothness and friction coefficient, and also enhances pitch control.

SIPERNAT® 880

This calcium silicate is used as a flow aid and anticaking agent in many applications. It also serves as a carrier substance for acid-sensitive active ingredients in plant protection that require a slightly alkaline pH value. In addition, SIPERNAT® 880 is an auxiliary in polychloroprene adhesives.

SIPERNAT® 44 MS

As an ultrapure zeolite, SIPERNAT® 44 MS serves as an anti-blocking agent in polyolefins for excellent haze and CoF values in high masterbatch loadings.

8:45 AM

The newspaper makes for better reading when SIPERNAT® is used as a specialty paper filler.

* Regionally restricted availability.

2.2 Description of Primary Physico-Chemical Characteristics

BET SURFACE AREA

The total surface of silica and silicates is measured in m^2/g, using the method of Brunauer, Emmett and Teller (BET) [J. Amer. Chem. Soc. 60, 309 (1938)]. The method is based on the absorption of gaseous nitrogen (ISO 9277).

AVERAGE PARTICLE SIZE

Ground precipitated products are dispersed in an aqueous suspension using ultrasound, followed by measuring the particle size distribution with laser diffraction equipment. For non-ground, spray dried silica, the particle size is determined with the use of an Alpine air-jet sieve. The average particle size of fillers generally has a major effect on performance (ISO 13320).

TAMPED DENSITY

This is a measure of the product weight in powder form. Approximately 200 ml of silica are tamped down 1250 times in the measuring cylinder of the tamp volumeter. The sample weight and the volume after tamping are used to calculate the tamped density, given in g/l (ISO 787-11).

LOSS ON DRYING

Precipitated silica and silicates contain a small fraction of physically bound water. After two hours of drying in a furnace at 105°C, the majority of the physically bound water has evaporated (ISO 787-2).

LOSS ON IGNITION

After calcinating at 1000°C for two hours, the water bound chemically in the form of silanol groups has also evaporated. The loss on ignition is determined based on the original substance, but calculated on substance dried at 105°C for two hours (ISO 3262-1).

PH VALUE

The pH value is measured by electrometry, using a glass electrode in a pH meter. The silica is suspended in water and measured as a 5% concentration (ISO 787-9).

DOA ABSORPTION (DIOCTYL ADIPATE ABSORPTION)

The DOA absorption (internal method) is a measure of a filler's absorbency, just like the oil number according to DIN ISO 787-5. However, this method can be carried out with greater precision than the oil number because it relies on an automated measuring procedure. In addition to absorbency, DOA absorption is also influenced by other parameters such as particle size.

SIEVE RESIDUE

The Mocker sieve residue is determined to detect the very small amounts of non-dispersible or difficult-to-disperse fractions which occur in precipitated silica and silicates. For this purpose, a silica suspension is flushed through the sieve under a water pressure of 4 bar. The sieve is subsequently dried and the sieve residue is calculated by weighing. The utilized sieves have a mesh size of 45µm, which corresponds to 325 mesh (ASTM).

WET SIEVE RESIDUE

A number of wet sieve procedures are employed to detect the very small amounts of non- dispersible or difficult-to-disperse fractions which occur in precipitated silica and silicates. While the determination of the sieve residue spray (based on ISO 3262-19) only destroys soft agglomerates, the determination of Mocker sieve residue (based on ISO 787-18) uses higher forces (approx. 4 bar water pressure), so that harder particles are also destroyed in the process.

In both cases, a silica suspension is flushed through the sieve by means of water. The residue is dried and the percentage is calculated on the basis of the initial silica amounts.

CHEMICAL ANALYSIS

SiO_2 is determined gravimetrically by fuming off the calcinated substance with hydrofluoric acid. The metal oxides Na_2O, Fe_2O_3 Al_2O_3 and CaO in the hydrofluoric acid evaporation residue are quantified by means of ICP-MS or ICP-OES and reported as element contents. Sulfate and chloride are measured with potentiometric titration.

* Regionally restricted availability.

2.3 SIPERNAT® – Typical Physico-Chemical Data/Hydrophobic Products

PROPERTIES AND TEST METHODS	UNITS	SIPERNAT® D 10	SIPERNAT® D 13	SIPERNAT® D 17
Behavior with respect to water		Hydrophobic		
Appearance		Loose white powder		
Particle size d50. laser diffraction based on ISO 13320	µm	6.5	10.5	10.0
Loss on drying. 2h at 105°C based on ISO 787-2	%	≤ 4.0	≤ 4.0	≤ 6.0
pH value. 5% in water/methanol = 1:1 based on ISO 787-9		10.3	10.0	8.0
Wettability by methanol Evonik method	%	≥ 56	≥ 58	≥ 52
Carbon content elemental analyzer LECO based on ISO 3262-19	%	3.0	3.3	1.7
Sieve residue 63µm. Alpine based on ISO 8130-1	%			≤ 1.0
Sieve residue 45µm. spray based on ISO 3262-19	ppm	≤ 400		
Tamped density. not sieved based on ISO 787-1	g/l	80	120	150
Loss on ignition[2]. 2h at 1000°C based on ISO 3262-1	%	≤ 8.0	≤ 9.5	≤ 6.0
SiO_2 content[3] based on ISO 3262-19	%	≥ 97	≥ 97	≥ 97
Na content[1] Evonik method	%	≤ 1.2	≤ 1.2	≤ 1.2
Fe content[1] Evonik method	ppm	≤ 400	≤ 400	≤ 400
Sulfate content[1] Based on ISO 19350	%	≤ 1.0	≤ 1.5	≤ 1.0
Authorization				FAMI-QS (EU) HACCP
Package size (net)	kg	15	25 lb	15
Availability		worldwide	worldwide	worldwide

The given data are typical values.
Specifications on request.

1) based on original substance
2) based on dry substance
3) based on ignited substance

All data accurate at the time at which the product leaves the production site

9:15 AM

With SIPERNAT®, the powder in my fire extinguisher stays effective.

2.3 SIPERNAT® – Typical Physico-Chemical Data/Hydrophilic Products

PROPERTIES AND TEST METHODS	UNITS	SIPERNAT®								
		22	22 S	22 LS	2200	25	33	35	383 DS	50
Behavior with respect to water		Hydrophilic								
Appearance		Loose white powder								
Specific surface area Multipoint. based on ISO 9277	m^2/g	190	190	180	190	190		170	175	500
DOA[1] based on ISO CD 19246	ml/100 g	235	240	235	225	260	≥ 255	245		295
Particle size d50. laser diffraction based on ISO 13320	µm	120	13.5	9.0	320		≥ 150	9.0	7.5	50
Loss on drying. 2h at 105°C based on ISO 787-2	%	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0
pH value 5% in water based on ISO 787-9		6.5	6.5	6.5	6.0	6.0	7.0	8.6	8.3	6.0
Sieve residue 45µm. spray based on ISO 3262-19	% ppm		≤ 1.5	≤ 300		≤ 0.3		≤ 0.1	≤ 3.0	
Sieve residue 63µm. Alpine based on ISO 8130-1	%	≥ 75					≥ 70			≥ 15
Sieve residue 125µm. Alpine based on ISO 8130-1	%									
Standard color value Y based on DIN 53163										
Electrical conductivity 4% in water. based on ISO 787-14	µS/cm	≤ 1300	≤ 1300	≤ 1300	≤ 1300	≤ 400	≤ 1300	worldwide ≤ 1400	≤ 1400	≤ 1200
Tamped density. not sieved based on ISO 787-11	g/l	260	90	70	250	125	215	75	90	175
Loss on ignition[2]. 2h at 1000°C based on ISO 3262-1	%	≤ 6.0	≤ 6.0	≤ 6.0	≤ 6.0	≤ 4.5	≤ 6.0	≤ 6.0	≤ 6.0	≤ 6.5
SiO_2 content[3] based on ISO 3262-19	%	≥ 97	≥ 97	≥ 97	≥ 97	≥ 98	≥ 97	≥ 97	≥ 97	≥ 97
Na content[1] Evonik method	%	≤ 1.0	≤ 1.0	≤ 1.0	≤ 0.8	≤ 0.5	≤ 1.0	≤ 1.4	≤ 1.5	≤ 0.6
Fe content[1] Evonik method	ppm	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400
Sulfate content[1] according to ISO 19350	%	≤ 1.5	≤ 1.5	≤ 1.5	≤ 1.0	≤ 0.2	≤ 1.5	≤ 1.5	≤ 1.8	≤ 1.0
Japanese Specifications and Standards for Food Additives Silica Gel						meets				
Authorization		HACCP. FAMI-QS (EU)	HACCP. FAMI-QS (EU)		HACCP. FAMI-QS (EU)	HACCP (Japan)				HACCP. FAMI-QS (EU)
Package size (net)	kg	25 NAFTA: 44 lb	15 NAFTA: 25 lb	20 lb (9.07 kg)	25	20	25	20 lb (9.07 kg)	10	20 NAFTA: 30 lb
Availability		world-wide	world-wide	world-wide	world-wide	Japan	NAFTA	world-wide	world-wide	world-wide

The given data are typical values.
Specifications on request

1) based on original substance
2) based on dry substance
3) based on ignited substance

All data accurate at the time at which the product leaves the production site.

SIPERNAT®												
50 S	500 LS	101 M	120	160	186	218	236	238	266	268	288	298
Hydrophilic												
Loose white powder												
500	500	250	130	170	195	160	180	195	160	185	195	200
280	270	155	200	260	235	230	220	225	225	225	225	225
18	10.5	7.5		13	11.5	11.5	13.0	13.5	12.5	12.0	10.5	10.5
≤ 7.0	≤ 7.0	≤ 9.0	≤ 6.0	≤ 4.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0
6.0	6.0	6.5	6.9	5.5	6.5	6.2	6.2	6.2	6.5	6.4	6.4	6.4
≤ 5.0	≤ 0.1	≤ 5.0		≤ 3.0	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0	≤ 0.3	≤ 0.3	≤ 0.3
			≤ 8.0									
			≤ 0.2									
		≥ 93		≥ 93		≥ 95	≥ 94	≥ 95				
≤ 1200	≤ 1200	≤ 300	≤ 1000	≤ 500	≤ 300	≤ 200	≤ 200	≤ 200	≤ 300	≤ 200	≤ 200	≤ 200
105	100	170	180	80	80	80	85	85	85	85	80	80
≤ 6.5	≤ 6.5	≤ 5.0	≤ 5.5	≤ 4.5	≤ 6.0	≤ 5.5	≤ 5.5	≤ 5.5	≤ 6.0	≤ 5.5	≤ 6.0	≤ 6.0
≥ 97	≥ 97	≥ 97	≥ 97	≥ 97		≥ 97	≥ 97	≥ 97		≥ 97	≥ 97	≥ 97
≤ 0.6	≤ 0.6	≤ 0.2	≤ 1.0	≤ 0.5		≤ 0.5	≤ 0.5	≤ 0.5		≤ 0.5	≤ 0.5	≤ 0.5
≤ 400	≤ 400	≤ 400	≤ 400	≤ 400		< 550	< 550	< 400		< 400	< 400	< 400
≤ 1.0	≤ 1.5	≤ 0.1	≤ 1.0	≤ 0.6		≤ 0.25	≤ 0.25	≤ 0.25		≤ 0.25	≤ 0.25	≤ 0.25
HACCP. FAMI-QS (EU)				HACCP. FAMI-QS (EU)								
12.5 NAFTA: 30 lb	20 lb (9.07 kg)	15	20	10 NAFTA: 20 lb								
world-wide	world-wide	world-wide	world-wide	world-wide		Asia	Asia	Asia		Asia	Asia	Asia

2.3 SIPERNAT® – Typical Physico-Chemical Data/Hydrophilic Products

PROPERTIES AND TEST METHODS	UNITS	SIPERNAT®							
		303	306	310	320	320 DS	325 AP	325 C	340
Behavior with respect to water		Hydrophilic							
Appearance		Loose white powder							
Specific surface area Multipoint, based on ISO 9277	m^2/g	565	355	700	180	180	130	130	175
DOA[1] based on ISO CD 19246	ml/100 g			265	195	210	215	200	235
Particle size d50, laser diffraction based on ISO 13320	µm	14	25	8.5		7.5			20.0
Loss on drying, 2h at 105°C based on ISO 787-2	%	≤ 8.0	≤ 8.0	≤ 5.0	≤ 7.0	≤ 6.0	≤ 6.0	≤ 6.0	≤ 7.0
pH value 5% in water based on ISO 787-9		5.0	5.0	6.0	6.2	6.2	6.9	6.9	6.5
Sieve residue 45µm, spray based on ISO 3262-19	% ppm			≤ 2.0		≤ 3.0			
Sieve residue 63µm, Alpine based on ISO 8130-1	%				≤ 10		≤ 8.0	≤ 8.0	≤ 25
Sieve residue 125µm, Alpine based on ISO 8130-1	%						≤ 0.2	≤ 0.2	
Sieve residue 250 µm, Alpine based on ISO 8130-1	%								
Standard color value Y based on DIN 53163					≥ 92	≥ 94			
Electrical conductivity 4% in water, based on ISO 787-14	µS/cm	≤ 1200	≤ 1200	≤ 1200	≤ 1300	≤ 1300	≤ 900	≤ 1000	≤ 1300
Tamped density, not sieved based on ISO 787-11	g/l	370	360	95	160	90	≥ 145	180	160
Loss on ignition[2], 2h at 1000°C based on ISO 3262-1	%	≤ 5.5	≤ 4.0	≤ 6.5	≤ 6.0	≤ 6.0	5.5	≤ 5.5	≤ 6.0
SiO_2 content[3] based on ISO 3262-19	%	≥ 97	≥ 97	≥ 97	≥ 97	≥ 97	≥ 97	≥ 97	≥ 97
Na content[1] Evonik method	%	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0
Fe content[1] Evonik method	ppm	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400
Sulfate content[1] according to ISO 19350	%	≤ 1.0	≤ 1.0	≤ 1.5	≤ 1.5	≤ 1.5	≤ 1.0	≤ 1.0	≤ 1.5
Total number of aer. microorg. acc. to Ph. Eur.	KBE/g								
Total number of aer. microorg. acc. to Ph. Eur. & USP/NF	KBE/g								
Total number of yeasts/molds acc. to Ph. Eur.	KBE/g								
Total number of yeasts/molds acc. to Ph. Eur. & USP/NF	KBE/g								
Dev. gram-neg. bact. acc. to Ph. Eur.									
Dev. gram-neg. bact. acc. to Ph. Eur. & USP/NF									
Japanese Specifications and Standards for Food Additives Silica gel		meets	meets						
Authorization									
Package size (net)	kg	20	20	20	25	10	20	20	30 lb (13.61 kg)
Availability		Asia	Asia	world-wide	world-wide	world-wide	Asia	world-wide	NAFTA

The given data are typical values.
Specifications on request.

1) based on original substance
2) based on dry substanc
3) based on ignited substance

All data accurate at the time at which the product leaves the production site

SIPERNAT®											
350	360	622 S	622 LS	625	680	BG-2	FPS-5	FPS-1	11 PC	22 PC	2200 PC
Hydrophilic											
Loose white powder											
55	55	180	180	180	175	180	190	200		190	190
170	190	225	225	225	250	235	255	255	90	235	225
4.5	18.5	13.0	4.5	85	50	14.0	5.8	7.0	9.0	120	320
≤ 7.0	≤ 7.0	≤ 7.0	≤ 7.0	≤ 8.0	≤ 5.0	≤ 7.0	≤ 8.0	≤ 9.0	≤ 7.0	≤ 7.0	≤ 7.0
9.0	9.0	6.5	6.5	7.2	6.5	6.5	6.2	5.9	6.9	6.5	6.0
≤ 0.1		≤ 1.5	≤ 0.03	≥ 55		≤ 1.5	≤ 4.0				
	≤ 10									≥ 75	
											75
≥ 95	≥ 95										
≤ 1300	≤ 1300	≤ 1000	≤ 1300	≤ 1300	≤ 1300	≤ 1300	≤ 400	≤ 150			
120	180	100	70	285	215	100	80	75			
≤ 6.0	≤ 6.0	≤ 6.5	≤ 6.0	≤ 6.0	≤ 6.0	≤ 6.0	≤ 4.0	≤ 6.5			
≥ 97	≥ 97	≥ 97	≥ 97	≥ 97	≥ 97	≥ 97	≥ 97	≥ 97			
≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.0		≤ 1.0	≤ 0.5	≤ 0.5			
≤ 400	≤ 400	≤ 600	< 600	≤ 600	≤ 400	≤ 400	≤ 400	≤ 400			
≤ 0.7	≤ 0.7	≤ 1.2	≤ 1.5	≤ 1.5	≤ 1.5	≤ 1.5	≤ 0.8	≤ 0.8			
									≤ 300		
										≤ 300	≤ 300
									≤ 100		
										≤ 100	≤ 100
									meets		
										meets	meets
HACCP. FAMI-QS (EU)											
12.5	20					20	10				
global	global		Asia			Asia	world-wide				

2.3 SIPERNAT® – Typical Physico-Chemical Data/Silicates

PROPERTIES AND TEST METHODS	EINHEITEN	SIPERNAT® 44 MS*	SIPERNAT® 820 A	SIPERNAT® 880
Behavior with respect to water		Hydrophilic		
Appearance		Loose white powder		
Specific surface (N_2) Multipoint based on ISO 9277	m^2/g		85	35
DOA[1)] based on ISO CD 19246	ml/100g		155	125
Particle size d50, laser diffraction based on ISO 13320	µm	3.0	7.0	8.5
Loss on drying, 2h at 105°C based on ISO 787-2	%		≤ 7.0	≤ 7.0
pH value, 5% in water based on ISO 787-9		11.5	10.1	10.5
Sieve residue 45µm, Mocker based on ISO 787-18	%			≤ 0.15
Sieve residue 45µm, spray based on ISO 3262-19	%		≤ 0.2	
Sieve residue 45µm, immersed based on ISO 787-7	ppm	≤ 100		
Standard color value Y based on ISO 787-1			≥ 95	≥ 95
Tamped density, not sieved based on ISO 787-1	g/l	550	215	260
Loss on ignition[2)], 2h at 1000°C based on ISO 3262-1	%		≤ 12.5	≤ 10.5
Dry volume content[1)] 1h at 800°C based on ISO 3262-1	%	80.0		
SiO_2 content[3)] based on ISO 3262-19	%	4	≥ 77	≥ 87
Na content[1)] Evonik method	%	14.0	4.5	≤ 2.0
Al content[1)] Evonik method	%	15.0	4.5	
Ca content[1)] Evonik method	%			6.0
Cl content[1)] Evonik method	%			≤ 1.0
Fe content[1)] Evonik method	ppm	≤ 200	≤ 400	≤ 400
Sulfate content[1)] based on ISO 19350	%	≤ 0.5	≤ 1.0	
Package size (net)	kg	20	25	25
Availability		worldwide	worldwide	worldwide

The given data are typical values.
Specifications on request.

1) based on original substance
2) based on dry substanc
3) based on ignited substance

* non-amorphous silicate
All data accurate at the time at which the product leaves the production site

6:00 PM

SIPERNAT® improves the quality of exterior and dispersion paints.

3. CUSTOMER SERVICE

3.1 Technical Service – globally available

Our application technology specialists are well prepared to support you – all over the world. Following the individual focal points of industries in each of the three regions – Americas, Europe and Asia Pacific – our Technical Centers are well in place.

This enables us to provide prompt technical support to our customers, while focusing on regional specific requests and tasks. Our experts work closely with you to understand your specific technical requirements. Based on our long-term experience in working with customers, it is our pleasure to present efficient solutions.

By joint innovation we aim to foster long-term relationships to provide you with competitive advantages in your consumer markets. At Evonik, innovation management means taking a cross-discipline approach to in-house R&D, production, process technology, product management and sales when it comes to market and product developments.

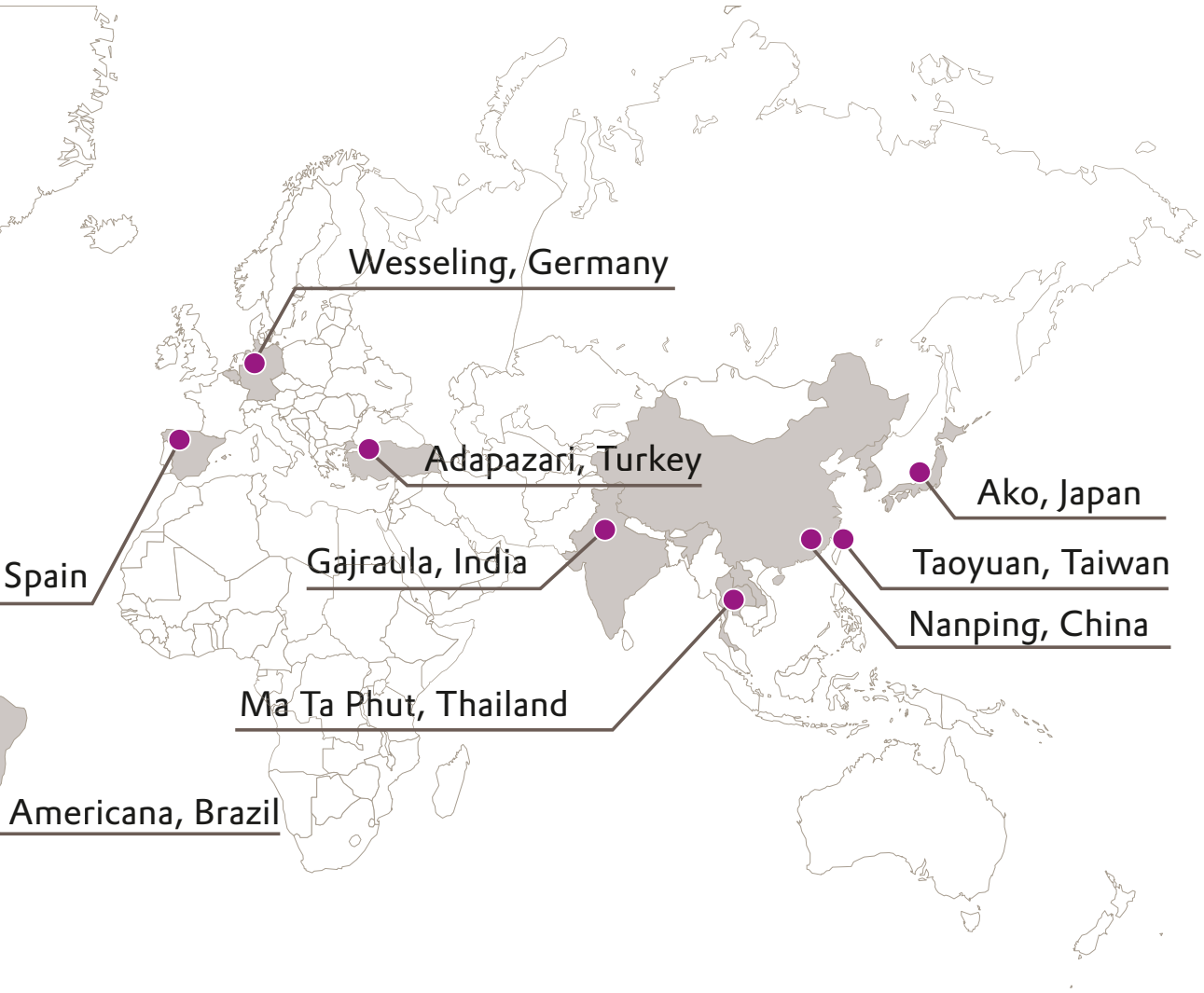
According to our slogan, "More than just a powder," service in application technology as well as support from our handling group is part of the total product package.

Examples of application technology services include:

- competent technical support by our application experts worldwide
- tailor-made solutions developed in our industry-specific application laboratories
- readiness for joint developments following new trends, that set benchmarks or increase customer profitability
- competence in handling powders and logistical concepts
- know-how shared in technical publications and brochures

Sound interesting? You can find an initial contact person on the back of this brochure.

SIPERNAT® products also facilitate the packaging of vegetables so thin plastic bags no longer cling to each other.



6:30 PM

SIPERNAT® makes it easy to remove my ice cubes from the mold.

4. PRODUCT SAFETY

Synthetic amorphous silica manufactured by flame hydrolysis or by precipitation in an aqueous solution is characterized by its amorphous structure. The determination method used on typical samples involves enriching the crystalline fraction followed by X-ray diffraction. The detection limit of this method is below 0.1% by weight. With consideration for this detection limit, the silica produced by Evonik Industries AG is considered completely amorphous.

4.1 Toxicology

Synthetic amorphous silica is used in a variety of products and processes. It produces no acute toxic symptoms when absorbed through the mouth or skin. Toxicity studies have shown that contact with synthetic amorphous silica does not irritate the eyes or the skin.

Prolonged skin contact with synthetic amorphous silica can cause dry skin or degenerative eczema. These reactions can be prevented by intensive protection and care of the skin. The data obtained from occupational medical examinations during decades of manufacture and use show no indication of sensitization potential. No cases of contact allergies have been reported. Synthetic amorphous silica has no mutagenic effect. No effects due to treatment were established after repeated oral intake. No teratogenic effect has been observed.

In inhalation studies, none of the examined synthetic amorphous silica led to lasting changes in the lungs or to progressive damage comparable to silicosis. Epidemiological studies on workers exposed to these substances in the long term showed no indications of silicosis.

The available data provides no indications of lung cancer or other long-term respiratory diseases.

ECOTOXICOLOGY

Synthetic amorphous silica is an inorganic substance with poor solubility in water. Based on this property, its bioavailability for aquatic organisms is very low. In acute tests conducted in accordance with OECD testing guidelines, no harmful effect was established either in fish or in water fleas (daphnia).

Due to the physical and chemical properties of the substance and its acute equal toxicity data, no chronic impact or accumulation in aquatic organisms is expected.

The generally applicable regulations for the determination of biodegradability (OECD and EC guidelines) only apply to organic substances. Synthetic amorphous silica is an inert inorganic substance and is not biodegraded by microorganisms.

The German Commission for the Evaluation of Substances Hazardous to Water (KBwS) has classified synthetic amorphous silica as non-hazardous to water (KBwS No. 849). Silicon dioxide has also been included in the OSPAR List of Substances/ Preparations Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR).

4.2 Information on Handling

Synthetic amorphous silica can be handled safely, with the use of good industrial hygiene and with observation of the applicable occupational exposure limits/threshold limit values. In Germany, a workplace exposure limit (AGW) of 4 mg/m^3 (inhalable dust fraction) must not be exceeded. Please refer to the safety data sheets for the applicable occupational exposure limits and other countries. If these values cannot be ensured, it is recommended to install local ventilation systems or to wear dust masks.

Electrostatic charges may form when handling Evonik specialty silica, so that the facilities used must be adequately grounded. To avoid a sense of dryness that results from contact with bare skin, Evonik specialty silica should be washed off with water and exposed skin should be treated with moisturizing cream. Spilled product should be collected with a minimum of dust build-up and collected in adequately sealable containers.

Evonik specialty silica can be disposed of in accordance with the recommendations in the European Waste Type Catalog, which is set up by industry.

4.3 Chemical Regulations

Based on currently applicable standards of Chemical Substance Legislation, the Hazardous Substance Advisory and Transportation Regulations, hydrophilic specialty silica products by Evonik Industries AG are not classified as dangerous substances or goods.

4.4 Further Information

FOOD ADDITIVES

Hydrophilic synthetic amorphous silicon dioxide (CAS No. 112926-00-8 resp. 7631-86-9) meets the quality requirements of EU Directive (EU) 231/2012 for direct food additives E 551, as we know from typical data.

FEED ADDITIVES

E551a** Hydrophilic synthetic amorphous silicon dioxide (CAS No. 112926-00-8 resp. 7631-86-9) is listed in the Union Register of Feed Additives to Regulation (EU) 1831/2003 as silicic acid, precipitated and dried.

EUROPE: REGULATION (EU) 10/2011

"Silicon dioxide" is listed under Ref. No. 86240 and CAS No. 7631-86-9 and may be used accordingly.

USA: 21 CFR

"Silicon dioxide" is listed in 21 CFR (Code of Federal Regulations, USA), Sec. 172.480 as an "anticaking agent" in food, which "may be safely used" with a limitation of <2%.

USA: FCC

Evonik specialty silica of type SIPERNAT® (CAS No. 112926-00-8 resp. 7631-86-9) meets or exceeds the requirements of the Food Chemicals Codex (current edition) monograph for Silicon Dioxide.

SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986

Evonik specialty silica does not contain any of the chemicals listed in the most recent "California List of Chemicals," published in 2014.

CONEG

Evonik specialty silica is in compliance with CONEG (Coalition of North East Governors) Model Toxic Legislation requiring that combined total levels of lead, cadmium, mercury and hexavalent chromium are less than 100 ppm.

TSCA

"Silicon dioxide, chemically prepared" is listed generically as

"silica" and is registered as CAS No. 7631-86-9 in the Toxic Substances Control Act (TSCA) Inventory.

OZONE-DEPLETING CHEMICALS

Evonik does not use Class I or Class II ozone-depleting chemicals in its production of specialty silica.

KOSHER

The specialty silica types SIPERNAT® by Evonik are certified kosher under the supervision of the

Chief Rabbinate of Jerusalem. The certification is renewed annually.

HALAL

The specialty silica types SIPERNAT® by Evonik manufactured according to HACCP in our Wesseling plant are "Halal" certified.

INCI

All hydrophilic synthetic amorphous SIPERNAT® grades (SIPERNAT® 22, SIPERNAT® 22 S, SIPERNAT® 22 LS, SIPERNAT® 50,

SIPERNAT® 50 S, SIPERNAT® 500 LS, SIPERNAT® 2200) are listed under the INCI name "Hydrated Silica."

For further information on product safety or for our safety data sheets, please contact

Evonik Resource Efficiency, RE-ES-PS
Phone +49 (0)6181 59-4787
Fax +49 (0)6181 59-4205

*/** For feed and food applications in the EU, only products from the Wesseling plant may be used, which were produced according to HACCP and FAMI-QS principles

5. REGISTRATION STATUS

PRODUCTS	CHEMICAL DESIGNATION	CAS-NR.	EINECS (EUROPE)	TSCA (USA)
SIPERNAT® 22 SIPERNAT® 22 S SIPERNAT® 22 LS SIPERNAT® 25 SIPERNAT® 33 SIPERNAT® 35 SIPERNAT® 50 SIPERNAT® 50 S SIPERNAT® 101 M SIPERNAT® 120 SIPERNAT® 160 SIPERNAT® 218 SIPERNAT® 236 SIPERNAT® 238 SIPERNAT® 268 SIPERNAT® 288 SIPERNAT® 298 SIPERNAT® 303 SIPERNAT® 306 SIPERNAT® 310 SIPERNAT® 320 SIPERNAT® 320 DS SIPERNAT® 325 C SIPERNAT® 350 SIPERNAT® 360 SIPERNAT® 383 DS SIPERNAT® 622 LS SIPERNAT® 500 LS SIPERNAT® 2200 SIPERNAT® BG-2 SIPERNAT® FPS-5 SIPERNAT® 622 S SIPERNAT® 680 SIPERNAT® FPS-1 SIPERNAT® 11 PC SIPERNAT® 22 PC SIPERNAT® 2200 PC	Silicon dioxide, chemically prepared	112926-00-8 resp. 7631-86-9	registered	registered
SIPERNAT® D 10 SIPERNAT® D 13	Silicones and siloxanes, dimethyl reaction products with silica	67762-90-7	registered	registered
SIPERNAT® D 17	Silane, dimethyl reaction products with silica	68611-44-9	registered	registered
SIPERNAT® 820 A	Silica, aluminum sodium salt	1344-00-9	registered	registered
SIPERNAT® 880	Silica, calcium salt	1344-95-2	registered	registered
SIPERNAT® 44MS**	Zeolite	1318-02-1	registered	registered

** non-amorphous silicate

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With SIPERNAT®, my spices flow freely into the saucepan without caking.

ENCS (JAPAN)	AICS (AUSTRALIA)	KECI (SOUTH KOREA)	PICCS (PHILIPPINES)	DSL (CANADA)	IECSC (CHINA)
registered	registered	registered	registered	registered	registered
registered	registered	registered	registered	registered	registered
registered	registered	registered	registered	registered	registered
registered	registered	registered	registered	registered	registered
registered	registered	registered	registered	registered	registered
registered	registered	–	registered	–	registered

7:10 PM

Soup mixtures come out of the package without clumping with SIPERNAT®.

6. PRODUCTION AND LOGISTICS

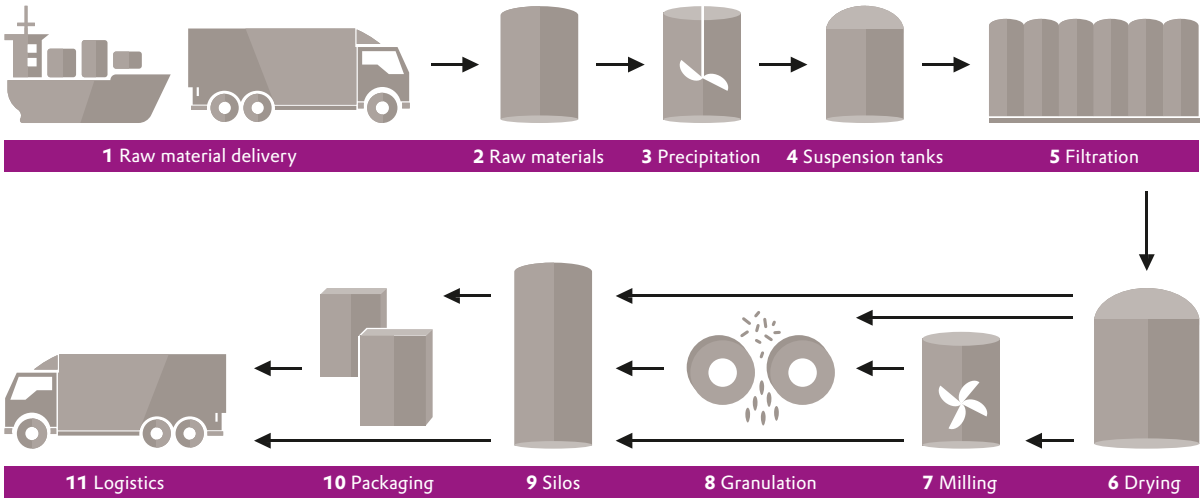
6.1 Production

The initial materials for obtaining silica by a wet process are solutions of alkali silicate, preferably sodium silicate, from which amorphous silica is precipitated by adding acid. After filtration washing and drying, the precipitated product consists of 86-88% SiO_2 and 10 -12% water; the latter being present both in the molecular structure and physically found on the surface.

Metal silicates such as calcium silicate and aluminum silicate are obtained by replacing a part or the total amount of the acid with metal salts, which form relatively insoluble precipitates within waterglass.

In order to remove as much water as possible and wash out the salt resulting from the precipitation, the silica suspension has to be filtrated! The filter cake still contains considerable quantities of water, making it necessary to evaporate up to six times the amount by weight of water in the drying stage. For this reason, drying accounts for a considerable portion of the production costs. Drying is carried out depending on the target properties of the final products. The drying process is frequently followed by grinding, classifying and/or granulating steps.

Production process for Specialty



8:00 PM

SIPERNAT® extends the shelf life of beer by preventing clouding caused by cooling.

6.2 Packaging, Transportation and Storage

STANDARD PACKAGING

The standard packaging for the silica and silicates described in this brochure is a multi-wall paper bag, which on a few occasions is reinforced with an intermediate PE layer. Depending on the bulk density and attempt density, the filling weight is between 10 and 25 kg.

Paper bags with intermediate film layers are only used for products that require an unusually high level of moisture protection.

The bag of goods always stretch-wrapped or shrink-wrapped and placed on disposable wooden pallets as standard packaging.

FLEXIBLE INTERMEDIATE BULK CONTAINER (FIBC)

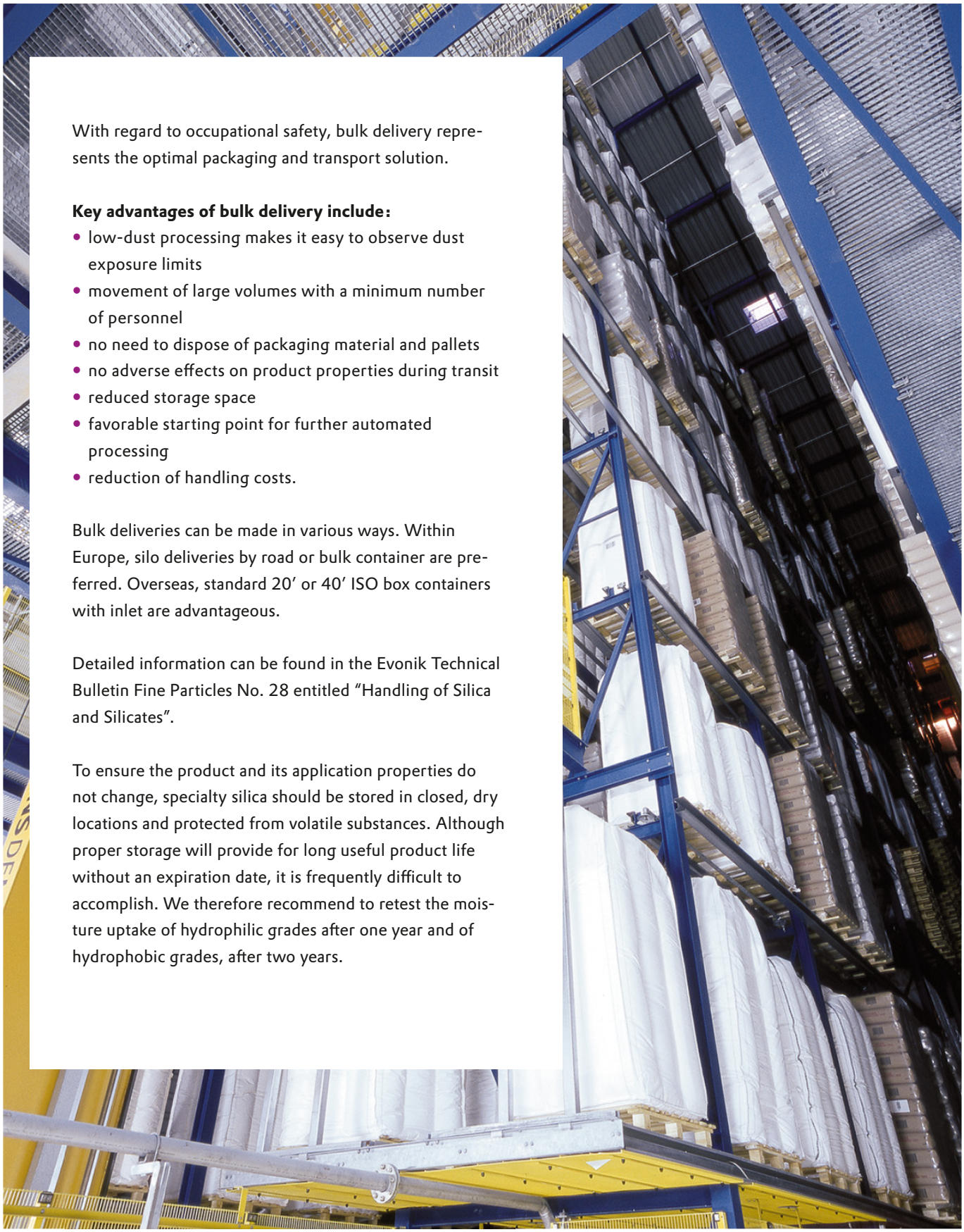
Evonik also offers silica and silicates in FIBC containers. In this case, the FIBCs are tailored specifically for the bulk solid properties of the individual products and may vary in design. Product characteristics must also be taken into consideration during unloading. Different methods of emptying are therefore used for various products in some cases. Generally speaking, the traditional gravity discharge method is applied, although in the case of fine-particle products, the PESy discharge system developed by Evonik may be given preference. Please refer to TI 1321 for further details on this concept, which differs considerably from the traditional gravity discharge method.

FIBCs are dispatched on disposable wooden pallets.

SILO TRANSPORTATION

For large consumption volumes, silica and silicates can be shipped in silo vehicles. Customers must have a sufficiently large storage silo to purchase products and silo vehicles. While road silo transportation has become common in Europe and Asia, rail silo vehicles are most widely used in North America. Here, road silo shipments are only used over short distances. The weights delivered using silo haulage depend on the bulk and tamped density and the vehicle capacity.

For further information on handling these products, please refer to Technical Bulletin Fine Particles No. 28, "Handling of Silica and Silicates". You will find detailed information on packaging silica and silicate in Technical Information TI 1232.



With regard to occupational safety, bulk delivery represents the optimal packaging and transport solution.

Key advantages of bulk delivery include:

- low-dust processing makes it easy to observe dust exposure limits
- movement of large volumes with a minimum number of personnel
- no need to dispose of packaging material and pallets
- no adverse effects on product properties during transit
- reduced storage space
- favorable starting point for further automated processing
- reduction of handling costs.

Bulk deliveries can be made in various ways. Within Europe, silo deliveries by road or bulk container are preferred. Overseas, standard 20′ or 40′ ISO box containers with inlet are advantageous.

Detailed information can be found in the Evonik Technical Bulletin Fine Particles No. 28 entitled "Handling of Silica and Silicates".

To ensure the product and its application properties do not change, specialty silica should be stored in closed, dry locations and protected from volatile substances. Although proper storage will provide for long useful product life without an expiration date, it is frequently difficult to accomplish. We therefore recommend to retest the moisture uptake of hydrophilic grades after one year and of hydrophobic grades, after two years.

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SIPERNAT® – based antifoam keeps suds from building up too much in the washing machine…
… when I do my laundry.

EUROPA/MITTLERER OSTEN/ AFRIKA/LATEIN-AMERIKA

Evonik Resource Efficiency GmbH
Business Line Silica
Rodenbacher Chaussee 4
63457 Hanau-Wolfgang
Germany

Telefon +49 61 81 59-12532
Telefax +49 61 81 59-712532
ask-si@evonik.com

www.evonik.com
www.sipernat.com

NORDAMERIKA

Evonik Corporation
Business Line Silica
299 Jefferson Road
Parsippany, NJ 07054-0677
USA

Telefon +1 800 233-8052
Telefax +1 973 929-8502
ask-si-nafta@evonik.com

ASIEN-PAZIFIK

Evonik (SEA) Pte. Ltd.
Business Line Silica
3 International Business Park
#07–18 Nordic European Centre
Singapore 609927

Telefon +65 6 809-6877
Telefax +65 6 809-6677
ask-si-asia@evonik.com

PO-101-EN-09-2018/02-L+L

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