

Silicas and Silicates for Animal Feed

Enabling customer solutions through advanced product
technology and dedicated application support



WHAT CAN SILICAS and SILICATES DO FOR YOU?

THE ADVANTAGES FOR YOU AND YOUR CUSTOMERS

- Dust-free concentrates
- Freely flowing powders
- Protection against clumping
- Can be dispensed with precision
- Consistent quality
- Saves money



Handling is becoming an increasingly important issue for feed additive manufacturers and processors whose customers prefer products that can be dispensed with precision and certainty in automated processes. The most suitable options here are freely flowing powders or microgranular products that do not cake or form dust. Achieving these characteristics means having to convert liquid substances or pastes into free-flowing powders. It also means maintaining flowability for powdered substances and preventing them from caking. Evonik has developed an outstanding line-up of high performing silica and silicate products for both applications. Through advanced product technology and custom application development, we can provide the optimal solution for your individual products.

Silicas and silicates help you as an absorbates manufacturer to convert liquid or paste feed additives into free-flowing powders

Many of the additives used in animal feeds, such as vitamins, organic acids, choline chloride solution, pigment dispersions, and antioxidants, are liquids and have to be blended into a powdered or granulated feed premix in subsequent processing steps. As an absorbates manufacturer, you deposit these liquids onto carriers so that the valuable additives can be dispersed homogeneously. Your customers want a free-flowing powder or granulate that they can blend with other dry substances in any given proportion.

Evonik's precipitated SIPERNAT® and ZEOFREE® silica products have long proven to be outstanding carriers in these types of applications. As highly absorbent, freely flowing, chemically inert, physiologically harmless material, SIPERNAT® and ZEOFREE® yield a finished absorbate

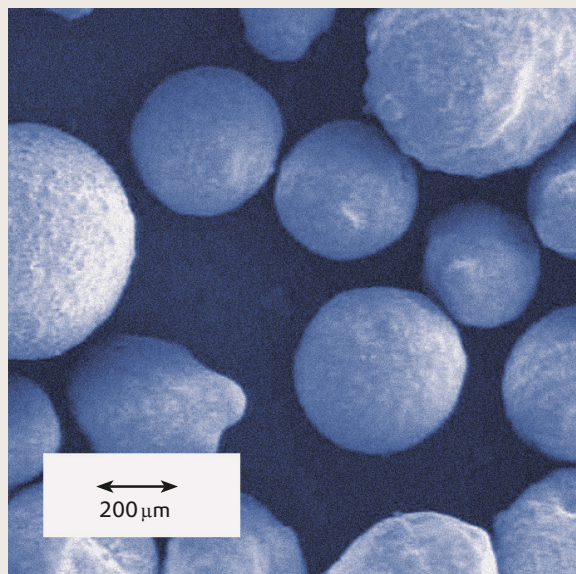
Figure 1



Vitamin E acetate as an oil and as an absorbate on SIPERNAT® 22

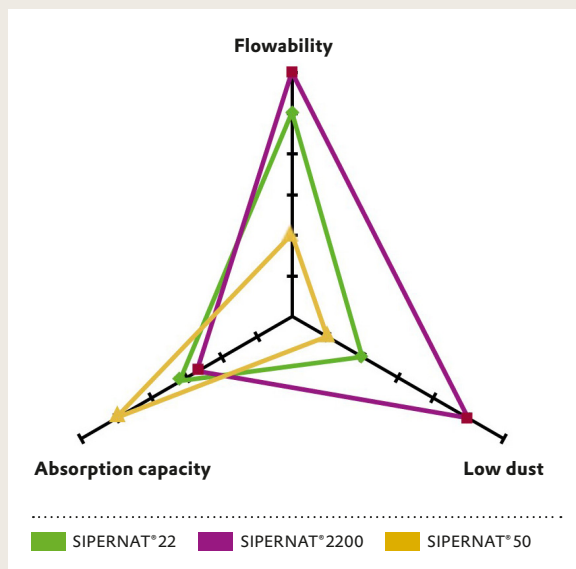
consisting of 50–75 wt% active agent, whose particle shape and handling properties are determined by the carrier silica. Evonik has developed SIPERNAT® 2200 specifically for producing dust-free absorbates.

Figure 2



SEM image of vitamin E acetate on SIPERNAT® 2200

Figure 3



Product profiles of globally marketed SIPERNAT® grades used as carrier silica

HOW DO YOU USE EVONIK CARRIER PRODUCTS?



Absorbing a liquid into the pores of a carrier powder requires a balancing of the carrying capacity of the carrier, the viscosity of the liquid, the liquid droplet size when sprayed onto the powder and the mixing conditions. To avoid disruption of the silica pores, gentle mixing conditions are preferred but in general different mixing conditions are recommended to be tested.

For highly viscous liquids the mixing time must increase. Principally, it is acceptable to increase the temperature of the system to induce lower viscosity for improved absorption. In general, using a spray nozzle to finely distribute the liquid on the carrier powder is preferred. The carrying capacity can be calculated according to the following equation:

$$\frac{\text{weight of the liquid}}{(\text{weight of liquid} + \text{weight of carrier})} \times 100$$

BENEFITS OF EVONIK CARRIERS

Increase economic efficiency due to the production of highly concentrated absorbates

Improve handling of high-viscosity liquids

Improve ease and accuracy of addition of chemicals used in small quantities

Silicas and silicates are tasteless carriers and will not add flavor

Silicas and silicates enable a high bioavailability of the carried liquid

As a premix manufacturer, silicas and silicates keep your premixes free-flowing and protect them from caking

As a premix manufacturer, you want to provide your customers with a freely flowing powder or granulate that does not tend to form lumps – even when in storage. Mineral premixes, vitamin premixes, and other powdered feed additives, however, do not flow well enough on their own. The addition of 0.5–2% of a hydrophilic silica or silicate product or 0.1–0.5% of our unique hydrophobic silica grade SIPERNAT® D 17 significantly improves flowability and reduces the tendency to cake. This allows users to dispense these valuable feed additives evenly, makes processing easier, and prevents costly downtime.

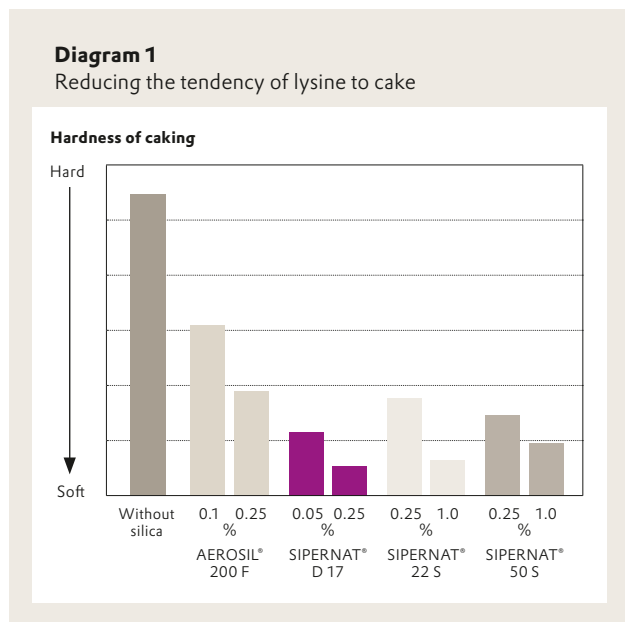


Diagram 1 shows how the tendency of lysine to cake can be improved by adding small amounts of various silica grades. SIPERNAT® D 17 is particularly efficient, as the hydrophobic nature of the silica inhibits further water uptake.

Figure 4 illustrates the anticaking effect of SIPERNAT® D 17 compared to a hydrophilic silica product in a swine feed sample at a concentration of 1% respectively.

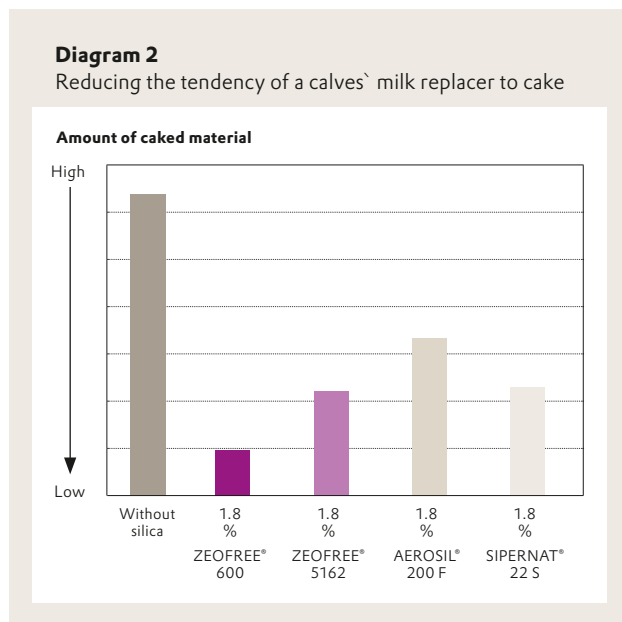


Diagram 2 shows how highly efficient the calcium silicate product ZEOFREE® 600 is reducing the tendency of a calves` milk replacer to cake. Using the hydrophilic precipitated silica products SIPERNAT® 22 S and ZEOFREE® 5162 yield comparably well results. Moreover, ZEOFREE® 5162 possesses a high mechanical stability, which is beneficial when high shear mixing conditions are applied within a production process.

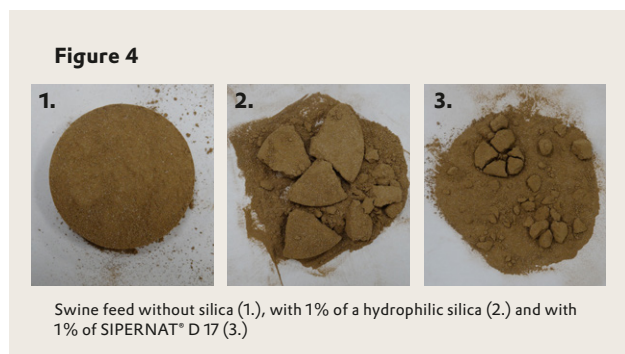
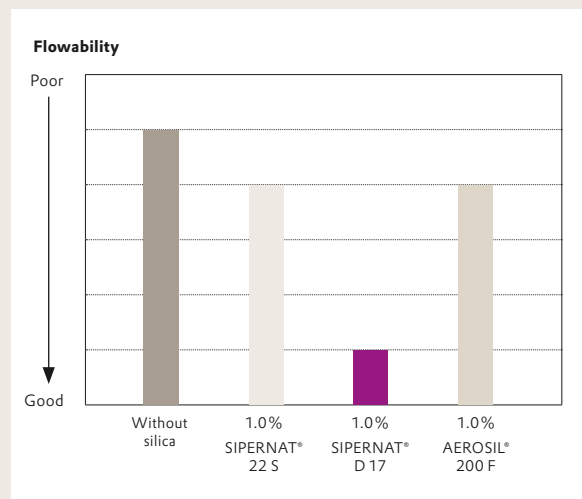


Diagram 3
Improving threonine flowability



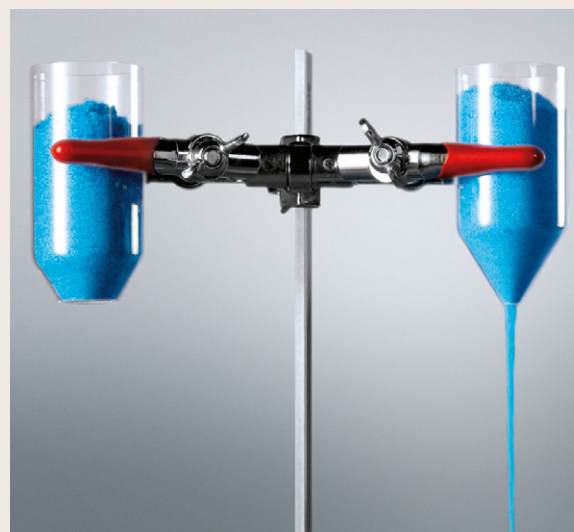
Along with reducing the tendency to cake, addition of our SIPERNAT®, ZEOFREE® and AEROSIL® products also improves flowability, as is the case for threonine (shown in **diagram 3**).

HOW DO YOU USE EVONIK FREE-FLOW AND ANTI-CAKING AIDS?

Keeping powders free-flowing requires a uniform coating of the silicas and silicates on the powdered animal feed product, thereby reducing interparticle interactions and absorbing moisture or liquids (water, oil, fats). Consequently, Evonik silicas and silicates must be blended carefully with the powdered product and it is recommended to test different mixing conditions. Silica and silicate powder particles that are too large relative to the host powder cannot adhere to the host and, thus, create dust. Dustiness is also caused when using excessive amounts of free-flow/anti-caking agent beyond what is needed to coat the surface of the host powder. Therefore, selection of the proper particle size free-flow and anti-caking agent and its total amount in the host powder is important. In many applications, the Evonik silica or silicate can be added to the spray dryer (or drying step) to ensure good contact with the substrate.

Figure 5 shows the free-flow effect of hydrophilic SIPERNAT® 22 S with copper sulfate, which is often used in mineral premixes.

Figure 5



Copper sulfate without and with the addition of SIPERNAT® specialty silica



BENEFITS OF EVONIK FREE-FLOW AND ANTI-CAKING ADDITIVES

Increased production throughput

Free-flowing powder offers faster production rates and increased capacity

Reduced production downtime and maintenance

Reduce or eliminate the need to stop equipment to clean out "clogged" powder

Improved product quality and consistency

Less off-spec or reject material from lumping and caking.

Increased satisfaction

Improve your customers' experiences with free-flowing, easy to use animal feed and nutrition powder products

RECOMMENDED PRODUCTS

... for your region

The following table shows an overview on our global product portfolio. Evonik offers a broad range of silica and silicate products designed specifically for animal nutrition products.

Table 1

PRODUCTS	PRODUCT TYPE	MARKETED REGIONS				
		Asia	Europe	MEA	North America	LATAMA
SIPERNAT® 2200	precipitated silica	●	●	●	●	●
SIPERNAT® 22	precipitated silica	●	●	●	●	●
SIPERNAT® 22 S	precipitated silica	●	●	●	●	●
SIPERNAT® 50	precipitated silica	●	●	●	●	●
SIPERNAT® 50 S	precipitated silica	●	●	●	●	●
SIPERNAT® 340	precipitated silica				●	●
SIPERNAT® 622	precipitated silica	●				
SIPERNAT® 350	precipitated silica	●	●	●	●	●
SIPERNAT® D 17	precipitated silica (surface treated)	●	●	●	●	●
ZEOFREE® 110 SD	precipitated silica				●	
ZEOFREE® 5161	precipitated silica				●	●
ZEOFREE® 5161 A	precipitated silica		●	●		
ZEOFREE® 5161 S	precipitated silica	●				
ZEOFREE® 5162	precipitated silica	●	●	●	●	●
ZEOFREE® 5170	precipitated silica				●	
ZEOFREE® 80	precipitated silica				●	●
ZEOFREE® 5133	calcium silicate	●	●	●		●
ZEOFREE® 250	calcium silicate	●			●	●
ZEOFREE® 600 / ZEOFREE® 600 LA	calcium silicate	●	●	●	●	●
SIPERNAT® 823 A	aluminum silica				●	
SIPERNAT® 807	aluminum silica				●	●
SIPERNAT® 807 A	aluminum silica				●	●
AEROSIL® 200 F	fumed silica	●	●	●	●	●
AEROSIL® 380 F	fumed silica	●	●	●	●	●

● Recommended products per region ● Recommended products per region under regional restrictions

... for your individual application

In individual cases, products may behave slightly different. We will be happy to respond to any additional questions you may have. We will help you to select the right silica or silicate product for your application and will be happy to advise you on questions on how to incorporate and handle the products.

The following tables summarize a few of the most important applications and the corresponding silica or silicate grade recommendations.

The recommendations are based on typical representatives of these application examples.

Table 2

YOUR CARRIER APPLICATION	SIPERNAT® 2200	SIPERNAT® 22	SIPERNAT® 50	ZEOFREE® 5161 A & ZEOFREE® 5161	ZEOFREE® 5170
Vitamin-E-acetate	++	+		+	++
Choline chloride	+	++		++	+
Organic acids	++	+	+	+	+
Antioxidants	++	++		++	+
Highly concentrated active absorbates			++		
Pigment pastes (e.g. Marigold)	++	+		+	+
L-Carnitin	+	++	+		

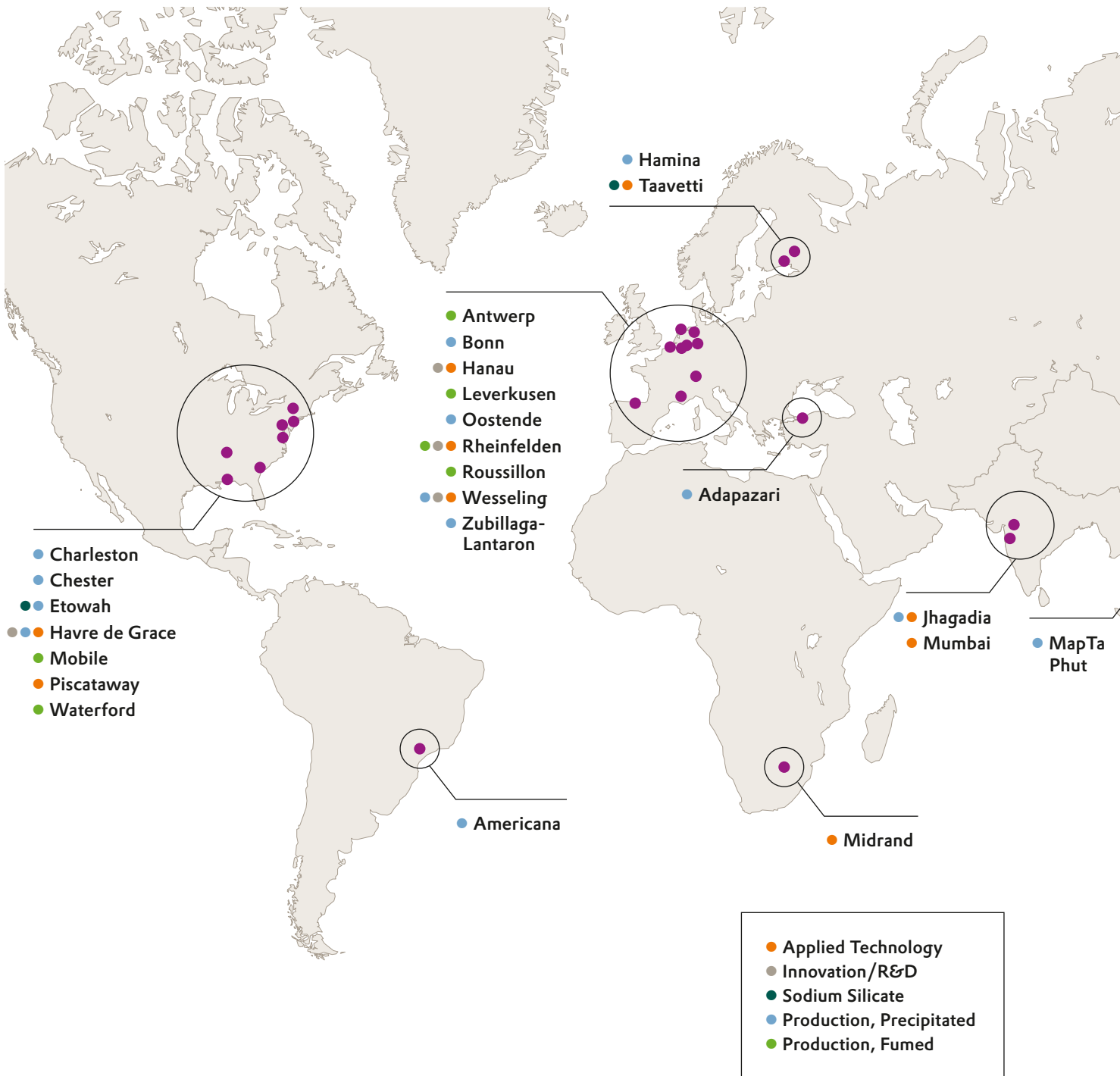
Table 3

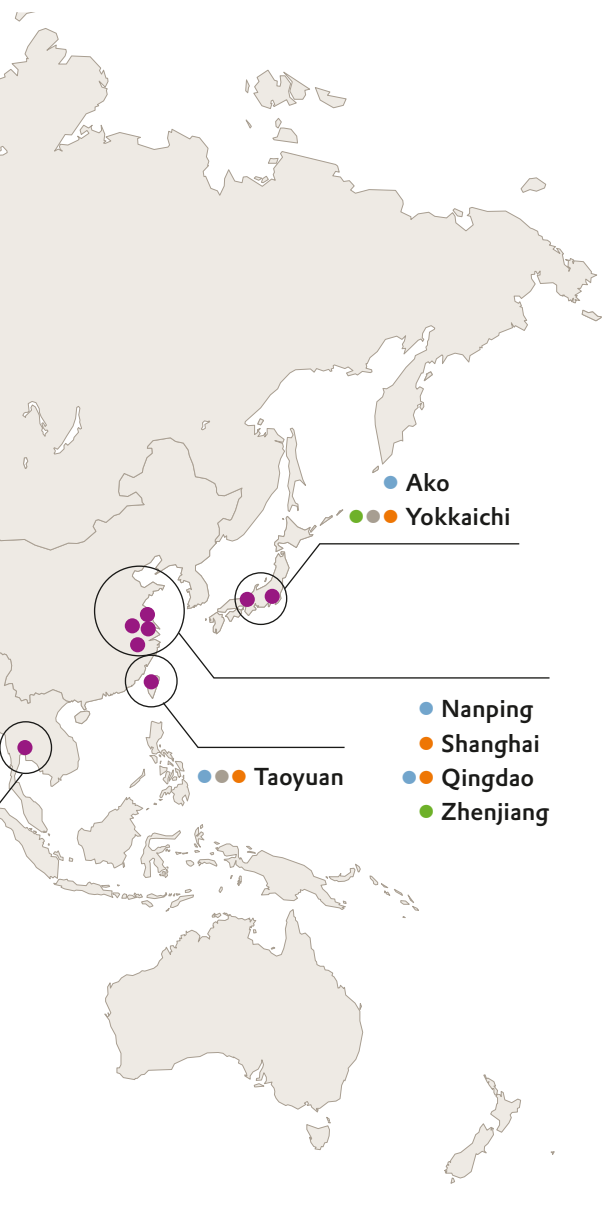
YOUR FREE-FLOW/ ANTICAKING APPLICATION	SIPERNAT® 22 S	SIPERNAT® 50 S	SIPERNAT® D 17	ZEOFREE® 600 & ZEOFREE® 600 LA*	AEROSIL® 200 F
Powder-like vitamins/premixes	++	++	++	++	++
Feed salts/mineral premixes	++	++	++	++	+
Pigment powders		++	++	++	
Amino acids/hydrolyzed proteins		+	++	+	
Choline Chloride powders/ absorbates			++		
Feed Urea	++	++			
Milk replacer	++	+		++	+
L-Carnitin powders/absorbates	+		++		

+ Recommended ++ Especially recommended

*under evaluation

EVONIK OPERATIONS GMBH – YOUR GLOBAL PARTNER





Handling, packaging and storage

Customers can easily handle these products without creating dust, and process (i. e., convey, measure out, blend, etc.) them within solid or liquid systems.

Silica and silicate products are largely chemically inert and their composition does not change, even over long periods of time. However, the relative large surface area of these products can lead them to adsorb volatile substances. In the case of moisture, this adsorption process is reversible. For this reason, we recommend storing all Evonik silica and silicate products in a dry location where they are protected from moisture or other organic vapors.

For more detailed information on product handling, packaging and storage please contact your local sales organization.

Regulatory approval for animal feed

Several products are currently permitted as technological additives for all animal species under Article 10 of Regulation (EC) No. 1831/2003 in Europe (E 551a/silicic acid, precipitated and dried, E 551b/colloidal silica and E 552/calcium silicate) and are listed in the "European Union Register of Feed Additives pursuant to Regulation (EC) No. 1831/2003."

Furthermore, several products are also in compliance with the conditions stipulated under 21 CFR (US Code of Federal Regulations) §573.940 (silicon dioxide), §584.700 (hydrophobic silicas), §573.260 and §582.2227 (calcium silicate) and §582.2727 (sodium aluminosilicate) as well as FSMA-related principles (Food Safety Modernization Act). Silicon dioxide is listed in the Official Publication of the Association of American Feed Control Officials (AAFCO) under Definition 73.046. Calcium Silicate and Sodium aluminosilicate are also listed in the AAFCO Official Publication under 21 CFR 582, Subpart C – Anti-caking Agents.

All products are manufactured at facilities certified according to the current ISO 9001 quality standard and following applicable Good Manufacturing Practices. Principles of HACCP are used to assess, monitor and control all potential hazards. All facilities are licensed by local authorities and periodically audited for feed safety and GMP implementation by a third party body or by government agency.

We are happy to provide Kosher and Halal certificates upon request.

Contact Evonik today for more information and to order a sample of our high performing specialty silica products:

<http://evonik.com/silica-feed>

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The Silica specialists at Evonik – Inside to get it right.