SIPERNAT® speciality silica and AEROSIL® fumed silica for the salt industry
Salts are among the most important raw materials. Especially sodium chloride, below referred to as “common salt” or briefly “salt”, is widely used in food as well as in industrial applications. Today there are a many different grades of salt, with different particle sizes, structures and contents of trace minerals.

In order to ensure exact dosing, it is crucial that the salt shows good flowability and does not cake on storage. SIPERNAT® speciality silica and AEROSIL® fumed silica are able to help provide excellent flow and long lasting storage stability for your salt grades.

Benefits for you and for your customer:

- Improved flowability
- More accurate dosing of salt into mixtures
- Reduced caking tendency
- Improved storage stability
- Increased productivity
- Constant quality
- Cost savings
- Reduced dustiness

The mentioned benefits also hold true for industrial salts other than sodium chloride.

Figure 1: Free-flowing salt at the breakfast table
Salts may pick up moisture from the air, resulting in the formation of saturated brine on the surface of the salt particles. For each salt there is a characteristic relative humidity that leads to this effect. It is equal to the water activity of the saturated solution of the respective salt. For common salt this is 75% relative humidity at 20 °C. Commercial grades of common salt however contain traces of more hygroscopic minerals such as magnesium chloride or calcium chloride. They liquefy at a relative humidity of 33% and 31% respectively. Furthermore salt crystals can adsorb traces of water even before the critical ambient humidity is reached. Thus, when storing salt, liquid bridges may form between the crystals, the salt becomes damp and the flowability decreases. Furthermore fluctuating relative humidity or temperature during storage may lead to repeated dissolving and recrystallisation resulting in hard caking.

**SIPERNAT® speciality silica and AEROSIL® fumed silica help keep salt flowable and prevent caking**

SIPERNAT® speciality silica and AEROSIL® fumed silica consist of very fine particles. They are able to cover the surface of salt crystals and act as distance holders or spacers. Moreover they have a high absorption capacity and can absorb liquid films from the surface of salt particles efficiently. The salt stays dry, flows well and does not cake. Even sea salt grades, containing traces of more hygroscopic minerals such as calcium or magnesium salts, can be kept dry and free flowing with the addition of silica products.

Hexacyanoferrates are used to keep sodium chloride from caking however their mode of action is different from the way silica works. They work by penetrating into the surface of the salt and changing the crystal structure when exposed to humidity thus reducing caking. They are not able to prevent more hygroscopic salt grades from becoming damp and sticky.
Experimental data

Figure 5 shows the flow improvement of pure sodium chloride containing 0.6% water, treated with different types of SIPERNAT® speciality silica and AEROSIL® fumed silica and with a common grade of TCP* (Tricalcium phosphate). The tests were performed using a set of six glass funnels (figure 4) with different outlet diameters. The evaluation is made with the grades “1” = excellent flow behaviour, i.e. the salt flows out from funnel No. 1 with the smallest opening without stopping, to grade “7” = poor flow behaviour, i.e. the salt no longer flows even through funnel No. 6 with the largest orifice. As can be seen any of the SIPERNAT® speciality silica and AEROSIL® fumed silica grades improved the flow considerably.

*Tested product Cafos M, producer Budenheim, Germany

Mixing technology

In order to obtain an optimum result when using a flow or anticaking agent, it is crucial to work with a suitable mixing equipment. Ploughshare mixers, paddle mixers, or ribbon blenders proved to be highly efficient for this purpose. The filling level should not exceed 70% of the mixer’s volume. The mixing time is dependent on the type of mixer; however, usually it will amount to only a few minutes in any case.

Detailed information on mixing technology is given in our Technical Information 1213 “Silica as flow agent and as carrier – Suitable mixing processes for powders and granulates”.

Figure 4: Set of glass funnels
Recommended products

The following table lists the most applicable grades of SIPERNAT® speciality silica and AEROSIL® fumed silica for use in common salt. Individual grades of salt may need a particular type of SIPERNAT® speciality silica and AEROSIL® fumed silica for best performance.

We will be happy to answer your questions in detail and assist you in choosing the right product for your individual application as well as information for best handling and processing our products.

Table 1

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
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<tbody>
<tr>
<td>AEROSIL® 200 F</td>
<td>Fumed silica with very fine particles, high chemical purity and high absorption capacity. Especially recommended for grades of highly chemical purity.</td>
</tr>
<tr>
<td>SIPERNAT® 22 S</td>
<td>Silica with fine particles and high absorption capacity. Recommended for highly hygroscopic salt grades such as sea salt.</td>
</tr>
<tr>
<td>SIPERNAT® 50 S</td>
<td>Silica with fine particles and very high absorption capacity. Especially recommended for highly hygroscopic salt grades such as sea salt.</td>
</tr>
</tbody>
</table>

Usual silica grades of Evonik Industries AG for the use in common salt

Figure 5

Flow grade

Addition level flow aid

Flow improvement salt
Handling, packaging and storage

Packaging & handling
AEROSIL® and SIPERNAT® products are delivered in multiply bags of various weights, depending on the product and market. We also offer certain silica products in semi-bulk packaging – the FIBC (Flexible Intermediate Bulk Container). The FIBC option offers dust-free discharge, requires less manual labor (compared to paper bags) and eliminates any possible risk of external contamination in a closed system. Bulk deliveries are available as well. For more information on packaging, please request our Technical Information 1232 “Types of Packaging for Performance Silica, the Technical Information 1231 “Packaging Forms for AEROSIL®”, the Technical Information 1219 “Semi-bulk Packaging for AEROSIL®” or the Technical Information 1321 “Semi Bulk Packaging for fine particle SIPERNAT® products”. Several options for dust free and automated handling (conveying, dosing, feeding etc.) into both solid or liquid systems are possible. For more detailed information regarding the handling of silica, please request our Technical Bulletin Fine Particles No 28 “Handling of synthetic silica and silicate”.

Please contact a sales agent in your area for detailed product/packaging/handling specific information.
**Storage**

Although AEROSIL® and SIPERNAT® products are largely chemically inert and their composition does not change chemically over time, their high specific surface area could result in the adsorption of volatile substances (in the case of moisture, this adsorption is reversible).

For this reason, we recommend storing all AEROSIL® and SIPERNAT® products in a dry place, protected from moisture and organic vapors. For more detailed information regarding the stability of silica please request the corresponding Product Information. During prolonged periods of storage, AEROSIL® fumed silica and SIPERNAT® precipitated silica may become slightly compacted. This can lead to a minor increase in tamped density, affecting the related product properties.

**Additional publications on the subject**

- Silica as a flow aid and carrier – suitable mixing processes for powder and granulates, Technical information TI 1213, Evonik Industries AG.
- SIPERNAT® speciality silica and AEROSIL® fumed silica in the food industry, Industry-Information II 2129, Evonik Industries AG.
- SIPERNAT® speciality silica and AEROSIL® fumed silica as flow aid and anticaking agent, Technical Information TI 1351.

**Food additive information**

All hydrophilic SIPERNAT® speciality silica and AEROSIL® fumed silica mentioned in this brochure comply with 21 CFR (Code of Federal Regulations, USA) § 172.480. Silicon dioxide is listed as “anticaking agent” which “may be safely used at a level not exceeding 2%”.

The mentioned hydrophilic SIPERNAT® speciality silica and the mentioned AEROSIL® fumed silica, are in line with food additive requirements for E 551 according to EU-directive 2008/84/EC, as we know from typical data. All silica products mentioned in this brochure are HACCP conform.

Kosher and Halal certificates are available on request.
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