Another newsletter?

Manufacturers of personal care products have thousands of different raw materials to choose from. New raw materials are constantly being developed that offer new and unique properties for the cosmetics of today and tomorrow. AEROSIL® fumed and SIPERNAT® precipitated silica have been used in personal care products for many years and therefore might be considered as “traditional” ingredients that, although very useful and of high quality, don’t have much new to offer. But is it really so? We at Evonik strongly believe that AEROSIL® and SIPERNAT® silica enable new and exciting formulation opportunities. Innovations don’t always have to be the result of new products, but the reimagining of existing ones. This newsletter is to inform personal care formulators and other interested persons of novel concepts and new developments relating to the use of silica in cosmetic formulations.

If you do not focus on new product formulation yourself, please feel free to distribute this newsletter on to your R&D colleagues or whoever might be interested in your organization.

SIPERNAT® silica particles for exfoliants

Exfoliating body and face cleanser formulations often rely on polyethylene beads to help rejuvenate the skin by removing dead cells. Recent reports on plastic waste accumulating in the oceans and finding their way into the food chain have raised concerns about the use of such microscopic polyethylene particles in a variety of applications. Hydrated silica, such as SIPERNAT® 22 PC and SIPERNAT® 2200 PC, are suitable replacements which overcome some of the pressing environmental concerns of plastic spheres. These alternatives, while being effective cleaning agents, even offer additional advantages for formulators.
Reports of gigantic swirls of plastic waste in the Pacific and Atlantic Ocean have drawn the attention to the question, what effects do the debris from plastic waste have on the environment? As plastic is exposed to mechanical and UV radiation induced decomposition, small plastic particles are formed as debris. Although plastic is usually regarded as inert, some reports have documented that microscopic plastic particles are ingested by marine species and, depending on their size, may reach their circulation system.

The discussion about the role of micro plastic waste in aquatic environments has recently raised concerns about polyethylene (PE) spheres, often used as abrasive particles in exfoliating personal cleaning products. Already at a UNESCO workshop 2010 in Paris effluents from waste water plants were listed as a source of microplastic contaminations in aquatic environments. Although PE beads in exfoliants are not the only origin of such contaminations, the growing debate has already lead one important producer of personal care products to announce that they will phase out plastic spheres in their exfoliants by 2015.

SIPERNAT® hydrated silica is a suitable alternative to PE microspheres as it is available in different particle sizes, applicable to the production of exfoliants. SIPERNAT® 22 PC (d50 particle size 120 µm) and SIPERNAT® 2200 PC (d50 particle size 320 µm) both feature a spherical particle shape. The particle size distribution of both materials is shown in Figure 1.

Hydrated silica is a non-harmful material as has been shown in a number of high volume studies. Hydrated silica, an inorganic material, is not biodegradable in the ordinary sense. Biodegradation ultimately leads to mineralization, which is not possible for a material that does already have a mineral nature. With its chemical composition, SiO2 is a close relative to the abundance of silicates that form the earth’s crust. The close relationship of hydrated silica is also the reason why this material is listed as a nature-identical inorganic material that can be used in natural cosmetic formulations certified by the NATRUE standard.

In contrast to hydrophobic PE spheres the SIPERNAT® particles have a hydrophilic surface that makes them easy to incorporate in aqueous solutions. As can be seen from Figure 2 SIPERNAT® powder poured into pure water immediately mixes in without any agitation being necessary. In a comparative experiment under the same conditions microspheres produced from polyethylene float on the surface of the water and require agitation and a surfactant to be wetted and dispersed in the liquid phase.

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6 For more information see http://www.unilever.com/sustainableliving/Respondingtostakeholderconcerns/microplastics/index.aspx
9 Microsrub 100PC of Micro Powders Inc., Tarrytown (NY), USA
The real advantage of the hydrophilic nature of the SIPERNAT® hydrated silica particles is not the easy incorporation in the formulation but mainly the behavior of the particles after their intended use as an abrasive exfoliant. When rinsing the exfoliant cleaner off the skin, the particles reaching the sewage system now have a dramatically reduced surfactant concentration compared to the original exfoliant formulation. To simulate this dilution 5 g of an exfoliant formulation prepared according to the guide formulation given in Table 1 containing either SIPERNAT® or PE spheres in identical concentration was poured in 10 fold of its volume of water. As can be seen from figure 3 after a standing time of approx. 30 min the polyethylene particles have migrated to the surface while the silica particles of SIPERNAT® 22 PC or SIPERNAT® 2200 PC have settled out. This has dramatic consequences for the fate of the particles in water treatment plants.

An additional advantage of SIPERNAT® 22 PC and SIPERNAT® 2200 PC is that the silica particles contribute to the viscosity build up which is achieved by the carbomer thickener, thus leading to a reduction of the necessary carbomer concentration to achieve the desired viscosity.

Table 1 gives a guide formulation for exfoliant cleaner containing SIPERNAT® hydrated silica.

**Table 1**  
<table>
<thead>
<tr>
<th>Component</th>
<th>Amount</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Microsud 100PC of Micro Powders Inc., Tarrytown (NY), USA</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 3** Formulation according to Table 1 using either SIPERNAT® 2200 PC (1) or polyethylene microspheres (2) diluted with the 10 fold volume of pure water. While the SIPERNAT® 2200 PC settles out suspended the PE microspheres start to float to the surface after standing for only approx. 5 min.
Exfoliant Facial Cleansing Gel

<table>
<thead>
<tr>
<th>Phase</th>
<th>Ingredients</th>
<th>INCI name</th>
<th>% w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water</td>
<td>Water</td>
<td>68.26</td>
</tr>
<tr>
<td>2</td>
<td>TEGO® Carbomer 341 ER</td>
<td>Acrylates/C10-30 Alkyl Acrylate Crosspolymer</td>
<td>1.00</td>
</tr>
<tr>
<td>3</td>
<td>SIPERNAT® 2200 PC or SIPERNAT® 22 PC</td>
<td>Hydrated Silica</td>
<td>5.00</td>
</tr>
<tr>
<td>4</td>
<td>Sodium Lauryl Sulfate, 28%</td>
<td>Sodium Lauryl Sulfate</td>
<td>20.00</td>
</tr>
<tr>
<td></td>
<td>TEGO® Betaine F 50</td>
<td>Cocamidopropyl Betaine</td>
<td>5.30</td>
</tr>
<tr>
<td>5</td>
<td>NaOH, 25%</td>
<td>Sodium Hydroxide</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>Preservative</td>
<td></td>
<td>q.s.</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 1  Guide formulations for a face and a body scrub

Processing
- Dissolve the TEGO® Carbomer 341 ER in water.
- Add further ingredients in the given order.
- Stir under vacuum.
- Adjust pH value with NaOH, 25 wt.%.

For further information on SIPERNAT® 22 PC, SIPERNAT® 2200 PC and any of our SIPERNAT® or AEROSIL® range of products for Personal Care, please contact us.

www.sipernat.com
www.aerosil.com

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