Microplastic in Cosmetics –
Alternatives for the sensory Profile

By Xenia Petsitis*

Abstract

Plastic material is a part of our reality and our daily life. It is difficult to imagine a world without plastics. Thus, we are confronted with the consequence of our enormous use of plastic material. Our oceans are littered with tons of plastic particles. The sources are industrial processes and they occur in our daily consumer goods like e.g. in cosmetics or clothing. Microplastic used in rinse-off cosmetics contaminate our environment, although this source just represents a small part of the environmental plastic pollution. Meanwhile the use of primary microplastic is forbidden in cosmetics in several countries, to prevent further damage. The vast majority of cosmetic companies are striving to rework their formulations with suitable alternatives, including non-rinse products like skin care and color cosmetics.

This article gives an overview about environmentally friendly replacements, that are mainly used as texture enhancers or functional fillers in various cosmetic applications.

The situation

A clear world-wide definition of the term microplastics does not exist yet. The U.S. National Oceanic and Atmospheric Administration (NOAA) classifies microplastics as particles, less than 5 mm in diameter. In October 2017, the European Commission (DG Environment) released the final report “Intentionally added microplastics in products”, that took personal care products, detergents and other industrial products under risk assessment and potential alternatives were discussed.

There are two existing classifications: primary and secondary microplastic. Micro sized plastic particles used in cosmetic formulations are originally manufactured for this purpose and belong to the category of primary microplastic. Secondary microplastic stem from all kinds of plastic material debris. Their very small sizes are the result of decomposition (caused by weathering and/or material aging) and can range between 1 and 1000µm. The primary micro sized particles as well persist in the environment as they are solid and non-biodegradable during sewage purification. They are poured down the drain after washing them off and the waste water treatment plant cannot decompose or filter them. Consequently, they pollute the rivers and finally the entire aquatic ecosystem is affected. The microparticles are ingested by sea organisms and at the end of the food chain it comes back to us via the sea food that we are consuming. The reactions to the body and implications – for the sea organisms and our own health – are not yet clarified completely.

Countries like Canada, United States, Great Britain, Sweden and France have already released regulations, respectively a plastic ban for such material used in cosmetics that are rinsed-off with water and go alive during or until the end of the year 2018.

What are we talking about?

Cosmetic raw material classes that are involved within this complex of problems are mainly Polyethylene, Polyurethane, Polyamide (Nylon), Polyacrylates, PMMA, PTFE and others. Their function is exfoliating, cleansing, viscosity modification, bulking, enhancing skin application etc. There are different types used for a broad range of formulations and it is essential to distinguish between insoluble (solid) and soluble (liquid) polymers. The latter are not primarily part of the ban as they are biodegradable and don’t cause the same environmental pollution. The insoluble small beads exist in different structures and have particle sizes between 10µm and 1mm (up to 5mm). Sometimes they are called microspheres, they can be hollow or not.

In rinse-off products like, peelings, scrubs or masks, natural materials like milled shells, kernels, salt or sugar crystals may replace the microbeads easily. Minerals like mica, silica and silica spheres represent an appropriate alternative for masks or skin applications without exfoliating purposes.

Microplastic in leave-on products is at present, considered as less crucial, but is not clearly out of the discussion. That’s why a lot of skin care and color cosmetics manufacturers are precautionary reformulating. PMMA or Nylon types were often used to improve the important (!) texture and application properties in skin care products. The amount included in one formula may vary from 1 up to 50 or more percent. Therefore, the performance of the new material is crucial and a substance that delivers compa-
rable performance is fundamental. Perfectly suitable exchanges can be found in the broad range of functional fillers. They help to secure the special requirements and the high performance demands of skin and personal care cosmetics. Functional fillers work as texture enhancers and are tailormade to influence the sensory profile of application properties. They play a major role in product development because consumers perception and high acceptance are essential keys for the brand success.

**Skin sensory and texture enhancers**

There are various alternatives available to formulate high performance cosmetics with environmentally friendly raw materials. Carefully designed functional fillers, for example, are available and offer a good scope of action for sensory profile improvement of emulsions or powders. Especially this area of cosmetics is of high importance, as higher amounts of microspheres are applied. Properties like high smoothness, good gliding or an elegant silky feeling are essential for powders and skin applications. The tactile experience is so to say always in focus. Additional functions like e.g. blurring or soft focus effects may be added to the list. The shape and structure of the particles are responsible for their behavior in the formulation. While spherical particles perfectly support a ball bearing effect, platelet structures provide good gliding and spreading. (See figure 1.)

Pure spherical shaped functional fillers improve the smoothness and thus the sensory profile of cosmetic formulations. They are a good choice to exchange plastic beads with a similar structure. RonaFlair® Flawless, for example, is composed of spheres only (see figure 2). Concentrations from 3 to 6% improve fluid

Figure 1: A microscopic picture of RonaFlair® Soft Sphere – a combination of platelets and spheres. The platelets are responsible for the good gliding on skin while the spheres foster the ball bearing effect.

Figure 2: REM picture of RonaFlair® Flawless. It is composed of spherical particles only.
formulations while powdery compositions benefit most from higher amounts like 10, 15 or 20%.

To create attractive cosmetics, a bundle of RonaFlair® Functional Fillers are available. They vary in terms of basic substance, powder color, shape and particle size to enable different functionalities in line with the targeted application.

<table>
<thead>
<tr>
<th>RonaFlair® Functional Fillers</th>
<th>Characteristics</th>
<th>Color</th>
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<tbody>
<tr>
<td>• RonaFlair® Boroneige Series INCI: Boron Nitride</td>
<td>platelets (6–30µm)</td>
<td>white</td>
</tr>
<tr>
<td>• RonaFlair® Soft Sphere INCI: Synthetic Fluorphlogopite, Silic platelets &amp; spheres (5–35µm)</td>
<td>white</td>
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<tr>
<td>• RonaFlair® Flawless INCI: Silica, CI77891, CI77491</td>
<td>spheres (1–25µm)</td>
<td>peach colored</td>
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<tr>
<td>• RonaFlair® LDP White INCI: Sodium Potassium Aluminum Silicate, CI77891, Silica</td>
<td>spheres (2–20µm)</td>
<td>white</td>
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Because the sensory profile is so important, a structured process to exchange the microplastic is very helpful. Whether it is smooth gliding, ball-bearing or other properties that are desired, compare the particle size, the color and covering influence in the formulation with the original substance. In general, functional fillers are versatile and may fulfill different targets. The bubble chart gives a helpful overview about the RonaFlair® functional fillers and their three main performance directions: mattifying, texture improvement or skin correction.

**RonaFlair® Boroneige® SF-3 or SF-6**

These two types are based on Boron Nitride and could be classified as true multi-talents. They are able to diminish fine lines and imperfections (soft focus) and are ideal for face care products. The sensory profile supports the richness and creaminess, especially of emulsions. There is a smooth mattifying and slight whitening effect, which is interesting for foundations, BB-Creams etc. The result is a light texture with maximal soft, rich and luxury touch.

**RonaFlair® Soft Sphere**

The inner structure is characterized by a combination of mineral platelets and spheres. This is the reason for the exceptionally good gliding and velvety skin feel. The spheres between the platelets transfer the ball-bearing effect to the texture. The higher the amount, the stronger the result in the formula is recognizable. This functional filler takes every cosmetic application to the next level, no matter if it is emulsions, sticks or powders are concerned.

**RonaFlair® LDP White & RonaFlair® Flawless**

These multi-beneficial spherical shaped fillers instantly support claims like soft focus or immediate wrinkle reduction. With their tactile and mattifying properties they serve as formulation enhancers in terms of radiance and natural skin tone complexion. Thus, all kinds of face applications may profit from the addition of one or the other RonaFlair® type.

Based on performed evaluations like sensorial handling, stability and the formulations impact, particularly the three mentioned RonaFlair® Fillers Soft Sphere, LDP White and Flawless are suitable replacements especially for Nylon based plastic beads.

**Summary**

Thus, a lot of sustainable options are available for an environmentally friendly texture enhancement. Be ready to take your part in saving the planet with us. Sometimes, just a little step is necessary to go on in the right direction.

In view of the variety of possibilities, which cannot be presented in detail at this point, we kindly like to offer to visit www.merck4cosmetics.com. As well as approach your local Sales Office and Account Manager in charge, for in-depth exchange of ideas and options.