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A New, Fully Minerizable Active Ingredient Gives Hair Hold and Shape – the Vegan Hair Setting Spray is Free from Organic Polymers and Microplastics

IPPM Technologies GmbH

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Organic polymers and microplastics pose a major challenge for our environment and our society.

Agricultural sewage sludge from wastewater treatment plants currently releases enormous quantities of polymer cosmetic additives into soils, inland waters and the world's oceans, where they are increasingly accumulating. Due to increased environmental awareness, there is growing pressure, particularly from consumers, to design cosmetic products in an environmentally friendly way and to avoid microplastics. The search for functional substitutes is proving extremely difficult. Hair cleansing products (shampoos), for example, can now deliver satisfactory results without critical substances such as silicones or synthetic emulsifiers. However, the market is still looking for environmentally friendly, biodegradable and minerizable alternatives, particularly in the area of hair setting products.

With Regulation (EU) 2023/2055, the EU has introduced a ban on the use of synthetic polymer microparticles in cosmetic products, among other things. Dissolved synthetic organic polymers, which are frequently used in hair setting products, such as polyvinylpyrrolidone, polyvinyl acetate, polyurethanes, polyacrylates and silicones, also represent a significant environmental burden. Research into alternative active ingredients with film-forming and strengthening properties is being conducted at full speed.

In a joint project with the Fraunhofer Institute for Silicate Research ISC, Translational Center for Regenerative Therapies TLZ-RT, the company IPPM Technologies GmbH, based at the Industrie Center Obernburg (ICO), has succeeded in producing novel silica clusters in a continuous sol-gel process using its specially configured microwave system.

These differ from the silica clusters conventionally available in sol-gel processes in terms of their structure and exhibit significantly improved film-forming properties and hair-setting effect. Curl retention tests demonstrate the ability to set curls and waves with comparable performance to commercially available hair setting agents.

The advantage is the complete degradation of the silica clusters to monosilicic acid, a natural component of aqueous systems such as soil, water and biological organisms. Monosilicic acid is a bioavailable form of silicon for plants; it strengthens cell walls and resistance to pests and plants. In higher organisms, silicon is associated with the strength and elasticity of bones, skin and hair.

The silica clusters show no cytotoxicity to primary human dermal fibroblasts. Their cyto- and geno compatibility was demonstrated in an in-vitro cell culture in accordance with DIN ISO 10993.

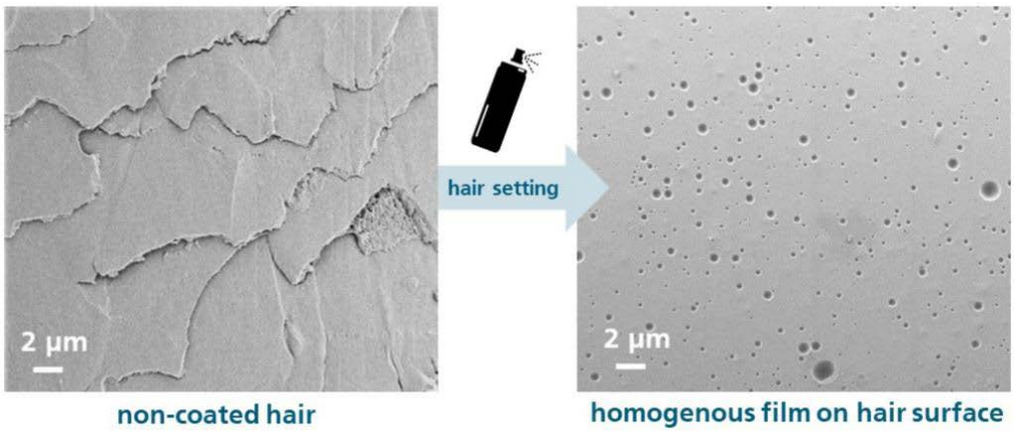

Fig. 1 Image of untreated hair (left) and hair coated using the biodegradable hair setting agent technology described (right). The cuticle structure of the hair is completely covered with a transparent, homogeneous coating. Source: Fraunhofer Institute for Silicate Research ISC

New development: Environmentally friendly, minerizable hair setting agent

The microwave-produced silica clusters are transparent with low-viscosity. They can be formulated with ingredients from natural resources into vegan, environmentally friendly hair sprays, free from genetic engineering, which form very thin, elastic films when sprayed onto the hair.

Using scanning electron microscopy **(Figure 1)**, which was carried out at the Fraunhofer Institute for Silicate Research ISC, the complete coverage of the treated hair can be verified and complete transparency of the film can be demonstrated by transmission measurement.

The outer cuticle of the hair is smoothed and provides a soft, smooth feeling, as the hair surface becomes more even and there is less friction. The hair becomes stronger and smoother at the same time.

The protective layer can protect against UV radiation and harmful substances. The layer affects the feel of the hair as it makes it less susceptible to moisture loss and dryness.

The applied layer can be completely removed when washing the hair. This is another significant advantage over conventional organic polymers, which are difficult to wash off the hair completely and leave a whitish residue.

Summary

Novel silica clusters produced in microwave-assisted sol gel processes can replace environmentally problematic organic polymers such as polyvinylpyrrolidone, polyvinyl acetate, polyurethanes, polyacrylates and silicones in hair sprays. This allows the production of toxicologically and ecotoxicologically harmless products for setting and conditioning hair.

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