Particle Technology: Small but functional
Cosmetic particles are today most often regarded as 'colourful, visual activators that catch the consumers’ eye on the shelf at retail. Yet increasingly particles are also performing more technically functional roles such as delivering active ingredients or exfoliating the skin. At the same time, marketers are becoming increasingly aware that cosmetic particles are effective in increasing product sales, a trend that also appears to be well underway and is showing no sign of abating.

Visible, suspended cosmetic particles can perform various functions, which otherwise may not be available to formulators because of an ingredient’s insolubility or lack of compatibility in the continuous phase. A specific example of a problem solved by inclusion of particles in a formula is the use of jojoba esters particles containing vitamins A and E in a clear, aqueous gel. It would be difficult to achieve clarity in an aqueous gel containing these hydrophobic ingredients alone. However, since the active ingredient is contained in cosmetic particles, they are mechanical, and thus, not chemically, suspended. The vitamins retain their functionality while having little, if any effect on the clarity or gel clarity, thus removing a difficult variable for formulators.

Cosmetic particles can also provide tactile appeal for a formula. Depending on the intended function of a product, the presence of visible, yet discreet particles can help the consumer perceive that the product is more complex than it appears. Cosmetic particles can also provide tactile feedback. For example, a cream containing a high concentration of particles may feel firmer than a cream without particles.

Inclusion in oil-in-water creams results in marked skin hydration improvement over controls. These studies show that the occlusive nature of SNL improves the efficiency of UV-blocking formulations. Further research will show whether larger lipid particles maintain or even enhance these effects.


cosmetic particles

One of the most popular functions that cosmetic particles can contribute to personal care products is exfoliation. Exfoliation removes dead cells from the surface of the skin, a process that is important for healthy, smooth skin. Skin cells turn over on an approximate 28-day cycle and flakes of dead skin form daily. The benefits of removing these dead cells include prevention of pore blockage, reduction of fine lines, and a softening and smoothing of the skin. Hard cosmetic particles included in a formula provide mechanical exfoliation, removing the layer of dead cells and unclumping pores. In addition, it is known that dry skin is better able to receive moisturizers. Hence, barrier protection of dead skin has been removed by an exfoliant. Thus, adding cosmetic particles to a formula that is designed to moisturize will increase its efficacy.

There are several types of exfoliating particles on the market, each with their own pros and cons. The original exfoliating particles came from natural materials. These have appeal in that they are ‘natural’ but they have limits since they are available in very fine sizes. Today, cosmetic particles are classified as ‘natural’ and may also have sharp edges and can cause microabrasions.

Larger, inorganic particles made from polyethylene, however, were introduced. Initially, these also had colour limitations and were only available in white. In addition, instead of being spherical, they were made from spheroidal polyethylene. Now they are available in many cosmetic colours and are available in a spherical form. Exfoliating particles are also available in the same size ranges and a variety of colours made from grades of polyethylene waxes such as microcrystalline wax.

More recently, exfoliating particles made from plant and petrochemical-based waxes have appeared on the market. These waxes include hydrocarbon-based and carnauba waxes. These types of exfoliating particles are available in a variety of colours and particle size ranges.


cosmetic particles are known to increase product sales


cosmetic particles

Delivery of active ingredients via cosmetic particles may also increase the efficacy of such particles. For example, studies have shown that vitamins A and E are unstable in water. However, when included in cosmetic particles, they are suspended in an oil matrix and can be carried by these particles. Formulators may also tailor the release-time of the particle. Different particle sizes are available for active delivery at load levels that can surpass 50% in some cases. Inclusion in cosmetic particles can also have benefits and the particles act as emollients. For example, jojoba esters have been shown to be effective in skin hydration.

Lipid particles incorporated in cosmetic formulations have several benefits. First, lipid particles can provide a ‘smart’ field of activity. Since their applications have not been limited to cosmetic formulations, the effect of particles on the efficacy of cosmetic formulations is still unknown. Much of the research so far is focused on small particle sizes. However, recent approaches have focused on larger particle sizes.

Visual appeal

The most straightforward function of cosmetic particles is aesthetics. Additives in various cosmetic systems have been compared to particles with a wide variation in PSD.


cosmetic particles

Figure 1 - This box illustrates the effect obtained by pigments a clear gel

The size of the coloured particles can also affect how light passes through a medium. By tailoring each particle size, for example, the visual effects can be created. For example, if larger particles are used and more than one layer of light is desired, the better approach may be to use a larger particle diameter. Figure 2 illustrates the size and particle size. According to Stokes’ law, which is generally lower than Fick’s law, the size of the particles has an effect on the rate of sedimentation. Intuitively, when particles are larger, they will settle faster. As particles get smaller, the rate of sedimentation is slower. The rate of sedimentation is complicated, and it involves many factors such as particle size and particle density. However, for practical purposes, Stokes’ law is used to predict the settling rate of particles. The equation used by engineers to calculate the rate of sedimentation of spherical particles in a fluid is the following:

\[ D^2 \times g \times (p - p_f) \times u^{10} \]

where \( D \) is diameter, \( g \) is the acceleration due to gravity, \( p \) is the density of the solid, \( p_f \) is the density of the fluid, \( u \) is the viscosity of the fluid, and \( u \) is the rate of sedimentation.

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‘macroemulsions’ using a polymer network can be extremely important. This scenario can be visualised as an invisible net throughout a formulation that traps the particles in suspension. Products on the market that accomplish this include various acrylate copolymers and natural gums such as xanthan and gellan. While the best methods of creating stable suspensions optimise as many of these variables as possible, inclusion of one of these suspending agents is essential for a stable formula.

**Soft & hard particles**

Composition is the first issue formulators might consider when selecting a soft particle to use. Two of the options available are hydrophobic particles consisting of oil soluble lipids and particles consisting of a matrix of cellulose or similar polysaccharide materials. This choice should be based mainly on the material’s stability or solubility in the formula and the desired feel of the particle.

Lipid-based cosmetic particles are available in several sizes and playtimes, made with either natural or synthetic waxes. Softer lipid cosmetic particles, which are capable of being completely rubbed into the skin without residual debris, represent a versatile alternative to hard beads when exfoliation is not the key function. If exfoliation is desired, soft beads may complementharder beads, delivering vitamins or added emolliency. New and innovative technology allows the production of particles that are extremely customisable in size, play-time and choice of active ingredients. This technology produces beads of extremely uniform particle size up to 2000µ. When made from jojoba esters, the variations in hardness are accomplished by blending jojoba esters with varying degrees of unsaturation, making available soft, spherical cosmetic particles that are guaranteed to be free of trans unsaturation.

Cosmetic particles that use a polysaccharide base such as cellulose, cyclodextrin or agar are also available in sizes comparable to that of lipid particles, generally in the 1000µ range. These beads can be produced using the same technology as lipid spheres so the same degree of monosizing is possible. These soft beads are useful for carrying active ingredients and providing aesthetics in formulas that might be hostile to lipid particles, such as high surfactant or oil-based products and for mild exfoliation.

Hard cosmetic particles can consist of completely hydrogenated plant seed oil, natural plant wax, ground nut shells or synthetic materials. In particular, spherical beads made of hydrogenated jojoba esters offer an excellent gentle alternative to harsh chemical exfoliants such as alpha- and beta-hydroxy acids and physical exfoliants such as polyethylene, pumice or ground fruit pits and nuts. Test panel results have demonstrated that cosmetic particles composed of hydrogenated jojoba esters have exfoliation efficacy similar to other natural and synthetic cosmetic particles while causing markedly less discomfort, which can be caused by microabrasions, for the subjects. Jojoba-based exfoliative particles are available in various colours and in sizes ranging from 100µ to 900µ. Similar cosmetic particles composed of rice bran wax, carnauba wax, polyethylene and microcrystalline wax are also available.

Including cosmetic particles in a formulation can provide value-added enhancements. Whether it is to add colour and contrast, to enhance emolliency, to deliver an active ingredient or to exfoliate, cosmetic spheres and beads are limited only by the creativity of the formulator. This explains their rapidly spreading popularity in nearly all areas of personal care products.

**Authors**

Melanie Cummings, Patrick Cappillino & Michele Ward
Floratech
Tel: +1 480 545 7000
Fax: +1 480 892 3000
E-mail: whatisnew@floratech.com
For a copy of the references contact spc@wilmington.co.uk