The stability of emulsions are determined by the particle size of the droplets and the interfacial tension between the water and the oil phases.

Many of the actives we need on our skins are delivered via emulsions which consist of water, emollients, actives, thickening agents and pigments. These emulsions have to be stable - if not, the appearance, viscosity, texture, shelf life and sensorial properties will be adversely affected.

There is an increased consumer awareness and demand for natural, environmentally friendly, sustainable and renewable cosmetics. These requirements also apply to emulsifiers and rheology modifiers.

Stable emulsions imply no phase separation, no phase inversion, no change in appearance (i.e. should be uniform from top to bottom), no oxidation or colour change, and should be microbe-free.

Two of the key factors that determine the stability of emulsions are the particle size of the droplets (depend on the energy input using high shear mixing) and reducing the interfacial tension between the internal (droplets) and external phases by adding suitable emulsifiers. The smaller the droplets, the better the stability of the emulsion. Most natural emulsifiers need high shear mixing to form stable emulsions.

Care must be taken with proteins and polysaccharides which could depolymerise or denature due to local heat generation around the homogeniser head.

Emulsifiers consist of a head and a tail (resembles a lollipop). The head is polar, electrically charged and hydrophilic (water soluble). Depending on its charge, the head can be anionic (effective at high pH levels), cationic (effective at low pH levels), non-ionic (not easily affected by pH or electrolytes) and amphoteric (pH is charge dependent. The tail is non-polar, electrically neutral, and hydrophobic (oil soluble). The level of emulsifiers used, which is often a blend of oil loving and water loving emulsifiers, should be sufficient to coat the droplets. The emulsifiers arrange themselves around the droplets, aligning themselves around the droplets to form micelles - the tail towards the oil phase and the head towards the water phase. In this way, a physical barrier forms between the droplets and the external phase, preventing coalescence of the droplets. The smaller the emulsifier molecule, the easier the adsorption or arrangement around the droplets.

Stephenson Personal Care offers a natural range of polyglycerol esters that are used

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as water-in-oil and oil-in-water emulsifiers. These are multifunctional, acting as moisturising agents and emollients. They are very safe to use (ideal for baby products) and can be used in leave-in and rinse-off products. Imagine a massage or baby oil that rinses *off* easily, leaving the skin soft and conditioned! They are also suitable for cold processing, saving energy and water when used as coolant in traditional manufacturing practices.

Various electrostatic interactions determine the stability of the emulsion - the closer the molecules of one phase are to each other, the higher the probability of coalescence. The larger the diameter of the droplets, the higher the probability of coalescence.

Once the droplets size has been reduced, they now have to be kept apart (stabilised) to prevent them from coalescing. Various gums and starches can be used to stabilise natural oil-in-water emulsions, acting as co-emulsifiers, by thickening the continuous or external phase (water phase). Stabilisers have to be carefully selected - if they are electrically charged, they could interfere with the charges on the emulsifiers, rendering these inactive. Assessa's Actimulsi GA20 is a natural multifunctional bioactive which acts as a co-emulsifier, it has soothing and anti-inflammatory properties, and it improves the sensorial properties of an emulsion. The Carbogreen rheology modifiers are combinations of natural biopolymers that form liquid crystals in very stable oil-in-water emulsions. The emulsion stability is not affected by pH or electrolytes and Carbogreen enables formulators to make preparations without using any emulsifiers.

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