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Crodafos CS20A

Cetearyl Alcohol (and) Ceteth-20 Phosphate (and) Dicetyl Phosphate

Crodafos CS20A is a high actives (50%) primary emulsifier based on the same chemistry used in the development of Crodafos CES. As such Crodafos CS20A is expected to provide the same enhanced oil deposition and fast delivery of water-based actives as the original phosphate-based emulsifying system. Crodafos CS20A is specifically designed to provide greater viscosity control and is especially suited for pourable emulsions with high active loads (e.g. liquid foundations) or other medium to low viscosity products such as body sprays, milks and depilatories.

For customers seeking a sustainable palm alternative, Croda offers SP-Crodafos CS20A-MBAL which is manufactured via RSPO's Mass Balance System.

Benefits

- Fast release of active ingredients
- Contains no DEA
- Complete emulsifying system
- Versatility in formulating
- Naturally substantive to skin
- Conditioned skin feel

Applications

- High-load pigmented systems
- Fluid emulsions
- Sunscreens
- Treatment/anti-ageing products
- Depilatories
- Skin cleansers

The precise composition of Crodafos CS20A is responsible for its unique emulsifying character. It contains an optimised ratio of alcohols and alkyl phosphates, which act synergistically to enhance the performance of the material. The phosphate ester link is very stable at high and low pH, giving Crodafos CS20A an extreme pH tolerance. The emulsion characteristics of the ester depend on the degree of neutralisation of the free A groups.

Crodafos CS20A offers advantages over other similar products on the market. As a pastille, it is easier to use. Crodafos CS20A also has a lower melting point (52-54°C) and maintains a more consistent viscosity, as it is much less sensitive to a high shear rate than other phosphate emulsifiers. Crodafos CS20A emulsions are also more aesthetically pleasing in that they do not display the typical graininess of these emulsifiers or develop "fish eyes" when pumped too quickly during manufacturing.

The use of Crodafos CS20A and its applications in personal care are covered under US patent 6,117,915 – issued to Croda on 12th September 2000.

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Phosphate Esters

Crodafos CS20A is a complex reaction mixture of mono and diesters of ethoxylated and non-ethoxylated alcohols. Crodafos CS20A is *Cryptoanionic* meaning that the anionic phosphate groups are shielded by the bulky alkyl chains. The structures illustrated below (Fig. 1) show some of the components.

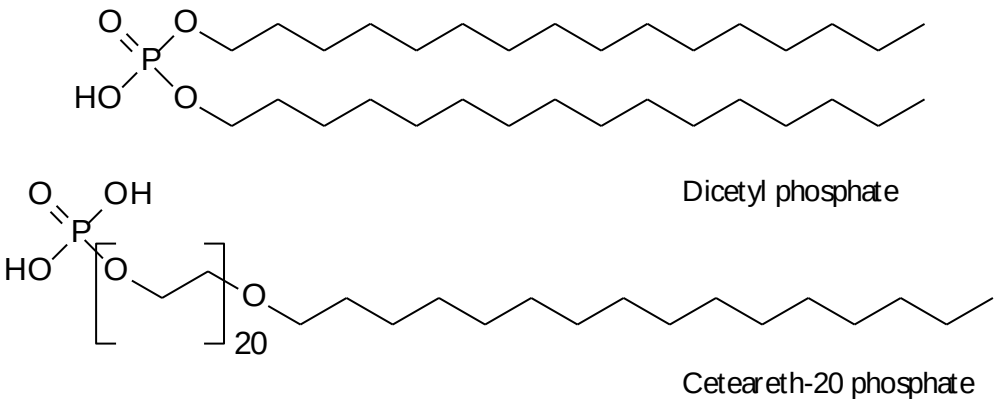

Figure: 1 Selected structures contained within Crodafos CS20A

Emulsion Characteristics

As a phosphate ester Crodafos CS20A is similar in structure to the phospholipids found in the skin. Hence, it is substantive and compatible with the skin's natural lipids. Like phospholipids, dialkyl phosphate esters have surfactant characteristics that tend to promote the formation of bilayers or lamellar structures. Such behaviour is thought to be the primary mechanism responsible for the enhanced oil deposition and fast delivery of actives observed with Crodafos CS20A (and Crodafos CES) emulsions.

Bilayer Formation:

Surfactants arrange themselves into micelles above their CMC (critical micelle concentration). Surfactants that possess one or more of the following characteristics can arrange themselves into bilayer structures:

- relatively low water solubility
- small polar head groups
- very large hydrophobic groups
- large flat ring structures.

Bilayers can either close to form vesicles/liposomes or arrange themselves further into lamellar structures which consist of alternating bilayers separated by aqueous layers. These lamellar structures play a key role in stabilising emulsions.

Proposed Deposition Mechanism:

When bilayers or lamellar structures are formed, they can trap within them lipids that make up the oil phase of an emulsion. The bilayer structures are destroyed upon shear (product application), causing the lipids to be released. This is believed to be the mechanism by which both Crodafos CES and Crodafos CS20A emulsions 'break upon application' to provide simultaneous release of oil and actives.

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Emulsifiers for Liquid Foundations:

Although nonionics and cationics have been used in foundations, anionics are the emulsifier of choice for make-up. They provide good emulsion stability, good pigment dispersion, easy spreading and blending, and a good skin feel. Anionic emulsifiers are also strongly recommended because most of the oxides and fillers used in foundation systems carry a negative charge above pH 6.5.

Liquid foundations can be difficult because the pigments they contain display characteristics and behaviour that can interfere with emulsion stability. This may cause a number of undesirable effects, such as undispersed colour, colour settling, pigment agglomeration, viscosity build over time, pigment flotation or migration, colour change during wear and inconsistencies in mass vs. skin tone. As a result, pigment preparation is crucial to the formulation.

Pigment flotation for instance is a problem that can occur during preparation of the water phase. At this point, there is no oil phase and therefore no emulsion has been formed. Pigment flotation is a separation of one or more of the colours at the surface. Such a migration of the pigments is due to their varying densities, wetting properties and electrical potentials at the surface.

Optimum stability of liquid foundations can be attained when low viscosity pigment dispersions are attained and the particle size is small and uniform. The choice of emulsifier can be crucial since it can facilitate in the wetting of the pigments so that they disperse properly. Following application nonionic emulsifying waxes are known to give a somewhat heavy and tacky after-feel. Emulsifiers with a very high Hydrophilic/Lipophilic Balance (HLB) affect the emulsion's detergency and cause the foundation to rub off quickly when in contact with moisture. In comparison, Crodafos CS20A, which has a mid-range HLB and less sensitivity to water, forms an oily film around the pigment and encapsulates it, making it a better choice. Crodafos CS20A produces stable and well-dispersed make-up systems, even in products that contain a relatively high load of pigments. The enhanced application properties of Crodafos CS20A emulsions allow for ample playtime and even coverage.

In addition to liquid foundations, Crodafos CS20A offers advantages in the formulation of many types of systems over other similar products on the market. Because Crodafos CS20A provides greater viscosity control, it is able to maintain better consistency over time and is much less sensitive to a high shear rate than other phosphate emulsifiers. Co-emulsifiers or suspending agents are not required to achieve emulsion stability. In forming emulsions, Crodafos CS20A forms emulsions without foaming and goes into the oil phase easily. Crodafos CS20A can be used to formulate very low viscosity 'milks'. These emulsions are elegant as well as stable, even when they contain a high oil phase. In sunscreens, Crodafos CS20A can accommodate a high SPF and spreads well, despite its relatively low viscosity.

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Neutralisation

Like Crodafos CES, Crodafos CS20A requires neutralisation which can be done easily *in situ* with a variety of bases during the emulsion formation. Equation 1 detailed below can be used to calculate the amount of base needed to neutralise Crodafos CS20A.

$$\text{Grams of Neutralising Base Required} = \text{Acid Value} \times \frac{0.70}{56100} \times \text{Grams of Crodafos CS20 Acid in Formula} \times \text{Mw of Neutralising Base}$$

Equation 1 Grams of neutralising base required per gram of Crodafos CS20A

Formulation

A selection of formulations are available which demonstrate the wide applicability of this material as an emulsifier. Please contact your local Croda sales office for further details.

Typical analysis

Appearance	Pastilles
Odour	Characteristic
A value, mg KOH	47
pH (2% IPA/Water, 50/50 at 25°C)	2.9

Certified Sustainable Palm – Mass Balance

SP-Crodafos CS20A-MBAL is Croda's sustainable palm oil variant allowing customers to use sustainably sourced material if they wish. The product is manufactured by the RSPO's Mass Balance system. The Mass Balance supply chain allows certified sustainable palm oil material and non-certified material to be mixed throughout the supply chain but administratively monitors the mass of certified material produced and sold. The Mass Balance system is fully audited allowing buyers of the material to view the products life span. Another advantage of this system is that it actively encourages palm growers to produce sustainable palm and move towards a segregated supply chain system. By choosing these ingredients, you contribute to the production of sustainable palm oil. Products manufactured with sustainable palm oil do not in any way compromise on performance.

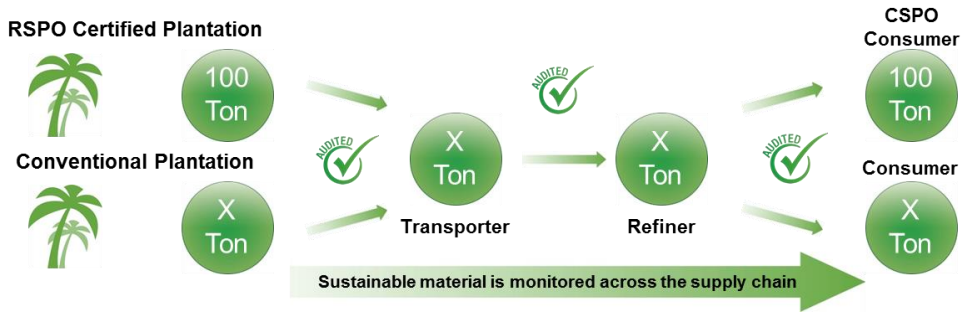

Figure 4: RSPO Mass Balance Supply Chain

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Non-warranty

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