Formulating high SPF broad-spectrum sunscreens for protection against UVB and UVA radiation to reduce the adverse effects of solar radiation is challenging, especially when they have to be suitable for all skin types.

Sunscreens can be hydro-alcoholic lotions, emulsions or anhydrous lotions. They should apply easily on the skin, remain without running, form a continuous homogenous film, leave a pleasant sensory feel and be safe for the individual and the environment.

The combination of all the ingredients, emulsion type, final pH and the rheology of the final product can affect the final SPF value.

The wide range of chemical sunscreen actives that are available are transparent, oil soluble and invisible on all skin types. They absorb sunlight and convert it into heat energy.

Mineral sunscreen actives reflect the harmful UVA and UVB rays away from the body. They are chemically and physically stable and consist of small primary particle sizes (PPS). When dispersed in a formula, these particles tend to agglomerate. The larger particles reduce performance and increase whitening. Kobo Products' **sunscreen technologies** include a variety of surface treated mineral actives and dispersions allow precise control of particle sizes to provide optimised UV protection and ease of use.

High SPF products (SPF 50) require high quantities of sunscreen actives and if chemical sunscreens are the only sunscreens used, the final product can be quite oily and hence also visible, especially on darker skin types. Oil-absorbing mattifiers such as Kobo Product's **MSS 500W,** a COSMOS approved microsphere, or Aqia's upcycled **Rice Silk SN** help to reduce shine.

Encapsulated chemical actives, such as the **Silasoma ™** range from Seiwa Kasei, are water-based dispersions. The polysilicone or amino capsule prevents direct contact of the sunscreen actives with the skin, ensuring safety for babies and sensitive skin. Silasoma dispersions can be thickened, cold-processed, are invisible and non-greasy on skin and can be used successfully in O/W emulsions in combination with mineral sunscreens for daily wear.

If only mineral sunscreens are used, especially non-nano particle sizes, chances are that they will still be visible on darker skin, hence not aesthetically pleasing. Zinc oxide has a lower refractive index than titanium dioxide, making it less opaque. The lower the PPS of either of these, the less visible it will be on skin. 20 nm ZnO and 10nm TiO2 primary particle sizes are generally invisible on skin type VI. Kobo Products Inc. has a range of guideline

formulations available, indicating SPF, as well as an SPF calculator based on their surface-treated powders and dispersions.

Mineral and chemical sunscreens can be combined – a daily wear SPF 50 broad spectrum guideline formulation using Silasoma and zinc oxide dispersions is available.

SunBoost ATB Natural, a blend of antioxidants, anti-irritant and anti-inflammatory agents at a proprietary ratio, is capable, when used in combination with organic and/or inorganic UV Filters, to boost SPF and PFA scores by more than 30% at use level 3.6-5%.