contain mixtures of chemical sunscreens which are thought to pose health risks from use. Accordingly, there is a need for additional broad-spectrum metal oxide based sunscreen formulations that do not have the negative drawbacks of traditional metal oxides sunscreens and which do not have the deleterious health effects of chemical sunscreens.

BRIEF SUMMARY

In one example the disclosure relates to a metal oxide sunscreen formulation which is not chalky, does not leave a white residue, and which is broad-spectrum and high sun protection factor (SPF).

In one example the sunscreen formulation contains a metal oxide, squalane, and one or more antioxidant. In another example the sunscreen formulation has a higher SPF than the metal oxide alone on a per unit mass basis. In yet another example the metal oxide is selected from zinc oxide and titanium oxide. In a further example the antioxidant is ethyl ferulate. In additional examples the sunscreen formulation contains a solvent. In a preferred example the solvent is water. In another example the sunscreen formulation contains a chelating agent. In a preferred example the chelating agent is selected from sodium gluconate, sodium phytate, EDTA, tetrasodium glutamate diacetate, trisodium ethylene diamine disuccinate. In yet another example the sunscreen formulation contains a surfactant. In preferred examples the surfactant is selected from caprylyl/capryl glucoside, coco-glucoside, isostearic acid, cetearyl glucoside, and arachidyl glucoside. In yet another example the sunscreen formulation contains a humectant. In a preferred example the humectant is selected from glycerin, propanediol, propylene glycol, hexylene glycol, butylene glycol, sorbitol, and xylitol. In a further example the sunscreen formulation contains an emulsion stabilizer. In preferred examples the emulsion stabilizer is selected from acacia senegal gum, xanthan gum, cellulose gum, microcrystalline cellulose. In another example the sunscreen formulation contains a viscosity increasing agent. In preferred examples the viscosity increasing agent is selected from cetyl palmitate, cetearyl alcohol, methyl dihydroabietate, behenyl alcohol, brassica alcohol, arachidyl alcohol, coconut alcohol, sorbitan palmitate. In yet another example the sunscreen formulation contains an emulsifying agent. In preferred examples the emulsifying agent is selected from sorbitan olivate, polyglyceryl-3 polyricinoleate, lecithin, glyceryl stearate, cetearyl olivate. In another example the sunscreen

formulation contains an additional emollient in addition to squalane. In preferred examples the additional emollient in addition to squalane is selected from caprylic triglyceride and capric triglyceride. In yet another example the sunscreen formulation contains a dispersing agent. In a preferred example the dispersing agent is selected from polyhydroxystearic acid. In an example the sunscreen formulation contains a skin conditioning agent. In preferred examples the skin conditioning agent is selected from sodium palmitoyl proline, and nymphaea alba flower extract. In another example the sunscreen formulation contains a preservative. In a preferred example the preservative is selected from phenoxyethanol, benzyl alcohol, hydroxyacetophenone, chlorophensin, potassium sorbate. In another example the sunscreen formulation contains a conditioning agent. In a preferred example the conditioning agent is ethylhexylglycerin.

In certain examples the metal oxide is from about 5% w/w to about 25% w/w of the formulation. In other examples the squalane is from about 1% w/w to about 25% w/w of the formulation. In yet other examples the antioxidant is from about 0.1% w/w to about 2% w/w of the formulation. In examples of the disclosure the metal oxide is about 14% w/w, the squalane is about 5% w/w, and the antioxidant is about 0.7% w/w of the formulation.

In one aspect, the present disclosure refers to a sunscreen formulation comprising a metal oxide, squalane, one or more antioxidants, and a skin protectant.

In another example the disclosure provides a method of preventing UV damage to skin of a subject comprising applying an effective amount of the sunscreen formulation disclosed herein to the skin of the subject. In an example of the method the sunscreen formulation is applied to the skin prior to exposure to UV light. In one aspect, the present disclosure refers to a method of preventing UV damage to skin of a subject comprising applying an effective amount of the sunscreen formulation disclosed herein to the skin of the subject, optionally wherein the sunscreen formulation is applied to the skin prior to exposure to UV light.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a graph showing the mean absorbance spectra obtained for the blank (control) plates.

Figure 2 is a graph showing the mean absorbance spectra in UV for the plates with the sunscreen study sample applied, before ultraviolet exposure.

Figure 3 is a graph showing the mean absorbance spectra in UV for the plates with the applied, after ultraviolet exposure.

Figure 4 is a graph showing the mean absorbance spectra for blank (control) plates in the analysis of broad-spectrum protection.

Figure 5 is a graph showing the protection of the sunscreen study sample in the analysis of broad-spectrum protection and calculation of critical wavelength.