

Trends in Cosmetic Formulation

With special reference to
Scrubs and Sunscreen Products

John Woodruff

Creative Developments (Cosmetics) Ltd.

Trends 0050 - to 1952

- 50 AD Galen & the Beeswax – Borax emulsion
- 1923; W.A. Poucher; Perfumes, Cosmetics & Soaps
- 1934; Francis Chilson; Modern Cosmetics
- 1937; H. Bennet; The Cosmetic Formulary
- **1941**; Maison de Navaare; Chemistry and Manufacture of Cosmetics
- 1948; R.G. Harry; Principles & Practice of Modern Cosmetics
- 1952; E. Sagarin; Cosmetics, Science & Technology

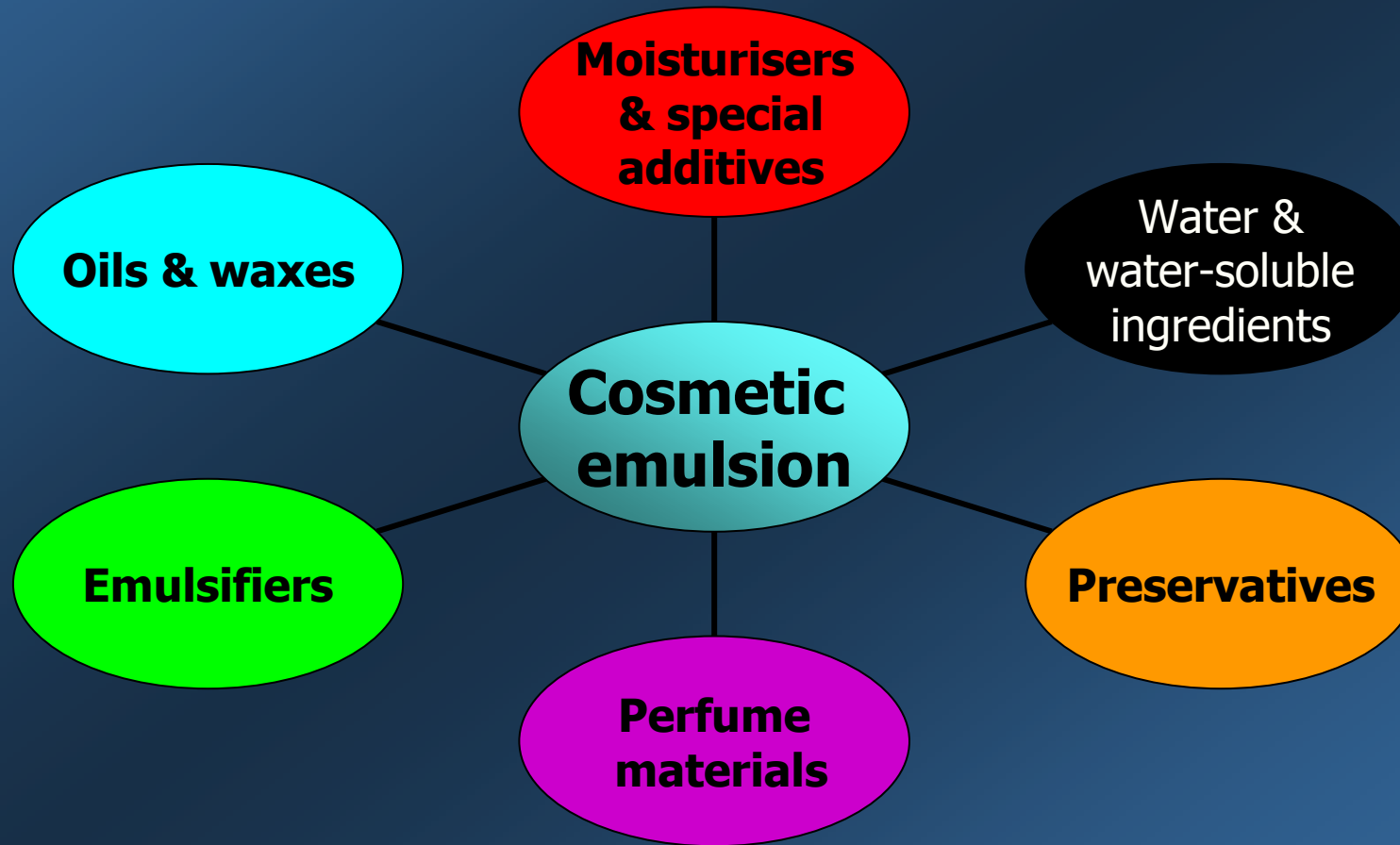
Trends 1953 to 1987

- 1953 – 1959 Not much changed
- 1960 John Woodruff joined Smith & Nephew Research
- 1976 Body Shop launched
- 1976 Regulations of the European Economic Community for Cosmetic Products, 76/768/EEC
- 1980s Private Label became respectable

Trends 1988 - 2010

- 1988 John Woodruff started own consultancy
- 7th Amendment to 76/768/EEC
- In-Cosmetics exhibitions
- Introduction of micronised UV absorbers
- Recognition of effects of UVA
- Rise of “natural” skin care
- Liquid crystal emulsifiers
- Formulate exhibitions
- Body butters & scrubs
- Growth of Internet

What are the ingredients?



Typical Oils & Waxes

- Prunus amygdalus dulcis (Sweet almond) oil
- Arachis hypogaea (Peanut) oil
- Persea gratissima (Avocado) oil
- Simmondsia chinensis (Jojoba) seed oil
- Prunus armeniaca (Apricot) kernel oil
- Cocos nucifera (Coconut) oil
- Caprylic/capric triglycerides
- Lanolin
- Cera alba (Beeswax)
- Candelilla cera
- Theobroma cacao (Cocoa) seed butter
- Paraffinum liquidum
- Petrolatum
- Isopropyl myristate / palmitate
- Ethylhexyl myristate / palmitate
- Glyceryl stearate
- Ozokerite
- Cera microcristallina (Microcrystalline wax)
- Cetyl, stearyl & cetearyl alcohol
- Myristic, palmitic & stearic Acid
- Dimethicone / cyclomethicone

Typical Emulsifiers

- Sorbitan laurate / palmitate / stearate / oleate
- Polysorbate-20 / -40 / -60 / -80
- Sorbitan olivate / PEG-n olivate
- Glyceryl stearate SE
- PEG-30 Dipolyhydroxystearate
- Ceteareth-n e.g. Ceteareth-20
- Laureth-n e.g. Laureth-20
- Cetyl potassium phosphate
- Sucrose cocoate

Typical Emulsifiers

Some emulsifier systems form liquid crystal structures, which contribute to stability

- Cetearyl glucoside with cetearyl alcohol
- Sorbitan olivate with cetearyl olivate
- Sorbitan stearate with sorbityl laurate
- Sorbitan stearate with sucrose cocoate
- Polyglyceryl-3 methylglucose distearate
- Potassium cetyl phosphate with hydrogenated palm glycerides
- Lauryl glucoside with polyglyceryl-2 dipolyhydroxystearate

Typical Moisturisers

- Glycerine
- Glycols,
 e.g. Propylene glycol
- Sorbitol
- Mannitol
- Sucrose / Fructose
 / Glucose
- Honey
- PEG-n
 – e.g. PEG-200
- Sodium PCa
- Sodium hyaluronate
- Hydrolyzed corn starch
- Panthenol
- Trehalose
- Aloe barbadensis
- Xylitol / Xylityl
 glucoside
- Hydrolysed proteins,
 peptides and amino acids

Typical Sunscreens

- Ethylhexyl methoxycinnamate [EHMC]
- Octocrylene
- Butyl methoxydibenzoylmethane [BMDBM]
- Benzophenone-3
- Ethylhexyl Salicylate
- Homomenthyl Salicylate
- Phenylbenzimidazol Sulfonic Acid
- Ethylhexyl dimethyl PABA
- Titanium dioxide
- Zinc oxide

Typical Preservatives

- Methylparaben
- Propylparaben
- Butylparaben
- Ethylparaben
- Phenoxyethanol
- Imidazolidinyl urea
- DMDM Hydantoin
- Mixed –thiazolinones
- Diazolidinyl urea
- Sorbic acid/Potassium sorbate

In order of use in USA

In 2007

Named Perfume Ingredients

- Alpha-isomethyl Ionone
- Amyl Cinnamal
- Anise Alcohol
- Benzyl Alcohol
- Benzyl Benzoate
- Benzyl Cinnamate
- Benzyl Salicylate
- Butylphenyl Methylpropional
- Cinnamal
- Cinnamyl Alcohol
- Citral
- Citronellol
- Coumarin
- Dipentene
- Eugenol
- Evernia Prunastri
- Evernia Prunastri (Oakmoss) Extract
- Farnesol
- Geraniol
- Hexyl Cinnamal
- Hydroxycitronellal
- Hydroxyisohexyl 3-Cyclohexene Carboxaldehyde
- Isoeugenol
- Limonene
- Linalool
- Methyl 2-Octynoate

The presence of the substance must be indicated in the list of ingredients when its concentration exceeds : a) 0.001% in leave-on products b) 0.01% in wash-off products

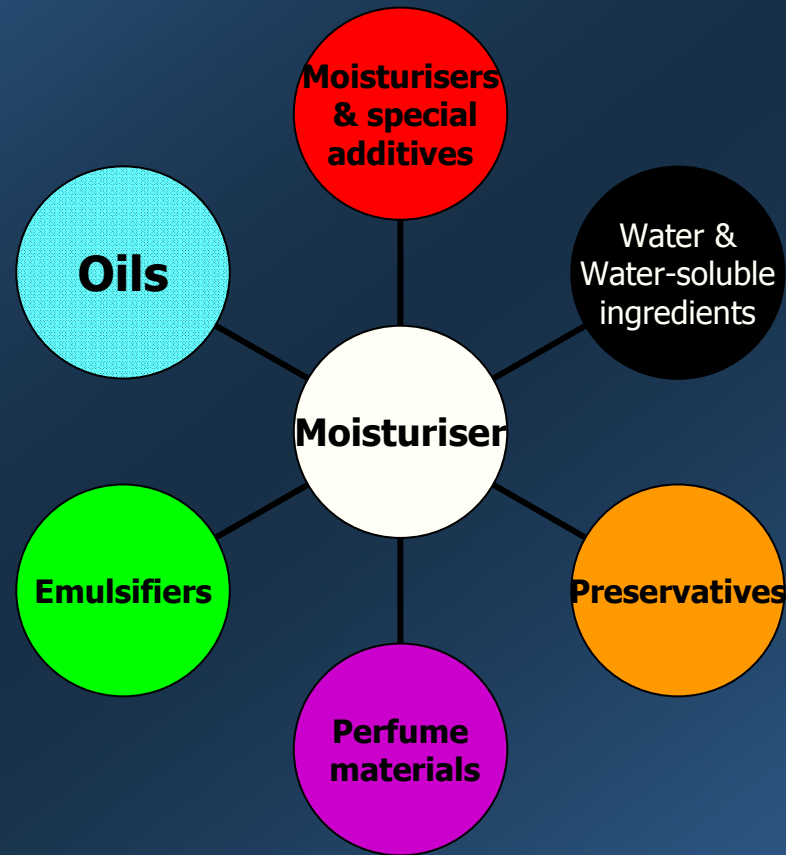
Typical Moisturiser

With UV Protection

Moisturiser with UV Protection

- Aqua, Ethylhexyl Methoxycinnamate, Glycerin, Cetyl Alcohol, Petrolatum, Cyclopentasiloxane, Stearyl Alcohol, Isopropyl Palmitate, Dimethicone, Carbomer, PEG-100 Stearate, Myristyl Alcohol, Stearic Acid, Palmitic Acid, Myristic Acid, Methylparaben, Propylparaben, Imidazolidinyl Urea, Titanium Dioxide, Sodium Hydroxide, Parfum, Linalool, Citronellol, Benzyl Salicylate, Amyl Cinnamal, Citral, CI 14700

What are the ingredients?



Day Moisturiser with UV Protection

- Ethylhexyl Methoxycinnamate, Titanium Dioxide, Glycerin
- Cetyl Alcohol, Petrolatum, Cyclopentasiloxane, Stearyl Alcohol, Isopropyl Palmitate, Dimethicone, Myristyl Alcohol, Stearic Acid, Palmitic Acid, Myristic Acid
- PEG-100 Stearate
- Aqua, Carbomer, Sodium Hydroxide
- Parfum, Linalool, Citronellol, Benzyl Salicylate, Amyl Cinnamal, Citral
- Methylparaben, Propylparaben, Imidazolidinyl Urea
- CI 14700

Day Moisturiser with UV Protection

Aqua, Ethylhexyl Methoxycinnamate, Glycerin,
Cetyl Alcohol, Petrolatum, Cyclopentasiloxane,
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Imidazolidinyl Urea, Titanium Dioxide, Sodium
Hydroxide, Parfum, Linalool, Citronellol, Benzyl
Salicylate, Amyl Cinnamal, Citral,

CI 14700

Sun Protection

Sun Protection Product Requirements

- A UV protection product must provide broad spectrum protection.
- Other key requirements include:
 - Cosmetic elegance (skin feel and transparency on skin)
 - Must be non-irritant and non-sensitising
 - Be water resistant
 - Show photostability for long lasting protection
 - Be cost effective

Broad Spectrum and UVA

- The European Commission guidelines on sunscreen products recommend that the UVA protection factor (UVA-PF) of a product should be at least one-third of the labeled SPF.
- The European guidelines further require that the critical wavelength of the product should be at least 370nm.
- The critical wavelength is a measure of the breadth of the UV absorbance spectrum; the greater this value, the more 'broad spectrum' the protection offered by the product.

Sun Protection Products

These present special problems

- Emulsion stability
- Agglomeration of micronised sunscreens
- Crystallising of organic sunscreens
- Failure to meet SPF declaration
- Failure to meet UVA requirements
- Failure to meet water resistance claims
- Photodegradation of actives

Protect from Solar Radiation

– Sunscreen Actives

- Organic screens
 - Less expensive
 - Well known properties & technology
 - » But possible irritation
 - » Possibly unstable
 - » Product / pack interactions
- Inorganic
 - Safe
 - Broad spectrum
 - » But whitening on skin
 - » Drag on application

Sun Protection Products

Agglomeration of micronised sunscreens can be seen under a microscope at 1000x magnification

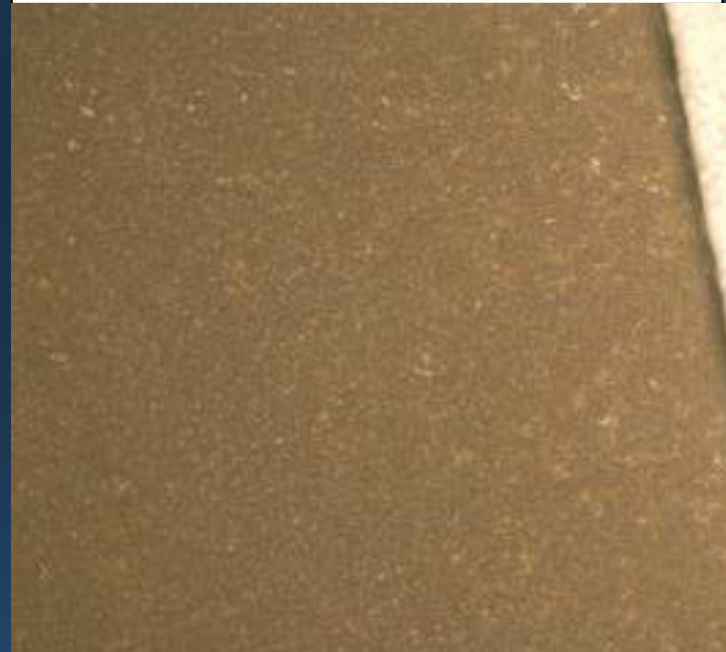
Use rheology modifiers to stop migration of particles – Veegum is good. Acrylic acid/VP Crosspolymer is also recommended

Preventing Agglomeration

TiO₂ Nano particles



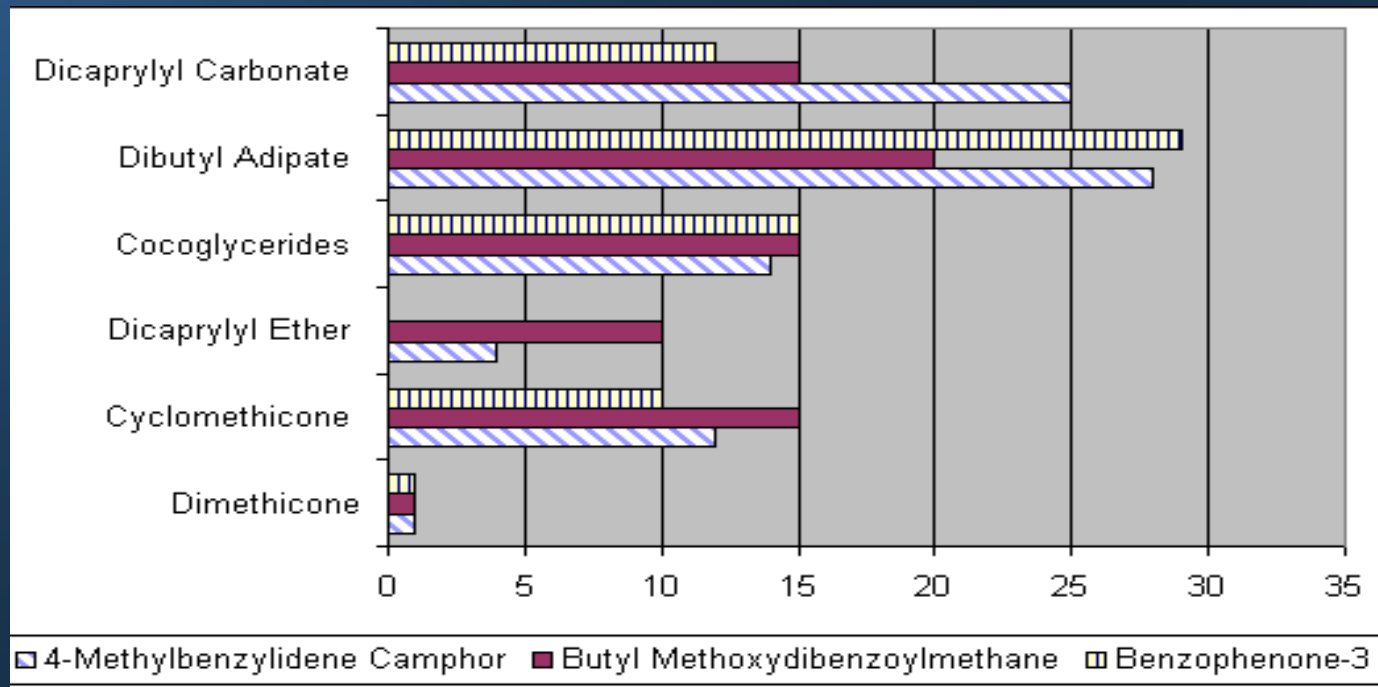
Zinc Oxide nano particles



Acrylic acid/VP Crosspolymer

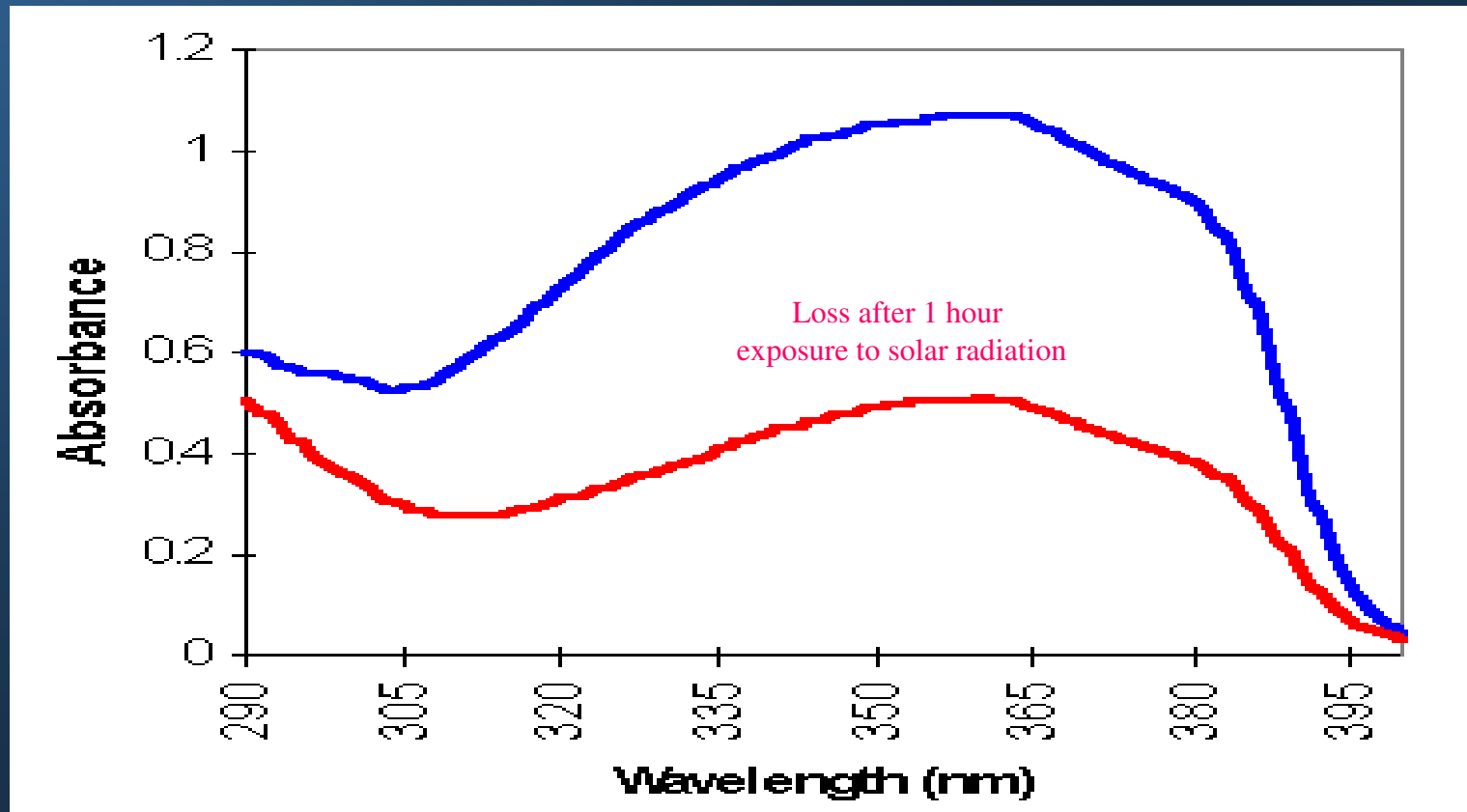
Crystallising of Organic Sunscreens

Check solubility in oil phase



If using Phenylbenzimidazole Sulfonic Acid
pH 7.3 - 7.7 is critical

Photodegradation of BMDBM



Improve UV Absorber Stability

- The UVA filter BMDBM is not photostable and may lose 60% or more of its activity at 360nm when exposed to solar radiation
- EHMC destabilises BMDBM / octocrylene mixtures
- Benzophenone-3 stabilises BMDBM weakly
- Octocrylene stabilises EHMC strongly but does not stabilise BMDBM
- Ethylhexyl methoxycrylene stabilises BMDBM strongly

Improve UV Absorber Stability

- There is a relationship between the rate of photo decay of BMDBM and the dielectric constant of the oil phase.
- As the dielectric constant increases BMDBM is progressively more stable until it reaches maximum stability at about 8.8, after which its rate of decay increases again.

UV Protect: Selecting the active

- Dependent on
 - Required SPF
 - UVA protection level required?
 - Intended market – legislation
 - Intended vehicle & pack form
 - » Clear gel
 - » o/w emulsion
 - » w/o emulsion
 - » Oil
 - » Spray

UV Protect: Selecting the active

- How can you determine which UV absorbers?
- SPF/UVA testing is expensive

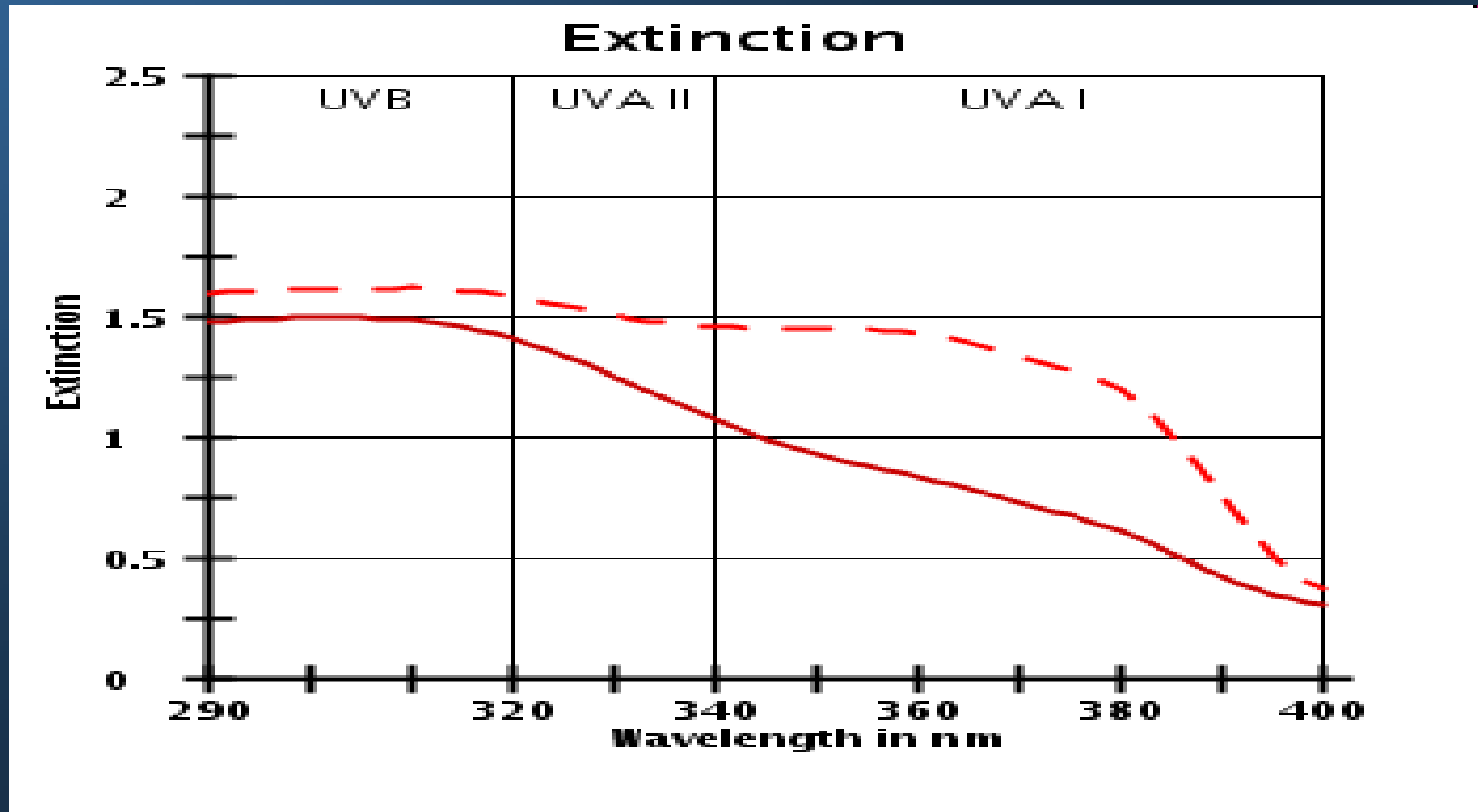
Try CIBA Simulator

» <http://www.sunscreensimulator.basf.com/>

UV Protect: Selecting the active

- Possible answer for o/w emulsion
 - Organic UV absorber
 - plus inorganic dispersion
 - » Not suitable for oil or clear gel
- e.g. 5% Ethylhexyl methoxycinnamate + 5% Octocrylene for UVB
- 5% Butyl methoxydibenzoylmethane for UVA
- 5% TiO₂ dispersion to extend UV protection into UVA

SPF 25 & UVA Pass



Face & Body Scrubs

Face & Body Scrubs

- Scrubs are a popular pre-treatment in Beauty Salons
- They are used to exfoliate dead skin cells prior to other treatments, particularly sun bed and artificial tanning
- Scrub aids can be any material with abrasive properties e.g. hydrogenated vegetable oils / polyethylene beads / ground nut shell / pumice / alumina etc.

Face & Body Scrubs

- The Scrub medium can be a face/body wash; an emulsion or a non-aqueous semi-solid
- Whatever combination is used the scrubbing aid must not sink or float
- The residue of dead skin cells, exfoliant and suspending medium must be readily removable
- http://www.connock.co.uk/articles_exfoliants.htm
 - Describes work that I did for A&E Connock some years ago

Face & Body Scrubs

- Determination of Yield Value required for suspending various exfoliants
- *Experimental Details*
- Three commonly used rheology modifiers were used to prepare gels of different strengths. The viscosity, Brookfield Yield Value and Bingham Yield Values were determined. Various physical exfoliants were then added to the differing gels and centrifuged to assess stability.

Face & Body Scrubs

- The yield values were determined at which the distribution of the physical exfoliant remained unchanged when centrifuged at 2,500 rpm for two minutes and at 5,000 rpm for two minutes.
- The laboratory work predicts the yield value necessary to achieve a stable product.
- It is not necessary to formulate products with a solid consistency and shower gels with suspended beads, cleansing emulsions, exfoliating scrubs and face and body washes may all be made at a viscosity to suit the application and preferred packaging.

Face & Body Scrubs

- When formulating such a product the basic formula is first decided, the most suitable physical exfoliant selected and the yield value to ensure its suspension determined.
- The yield value of the base formula is then measured and adjusted by the addition of a suitable rheology modifier.

Salt Scrubs

- Problems
 - Salt dissolves
 - So preferably non-aqueous
 - Salt is heavy
 - Gelled carrier
 - Non-aqueous = oily = difficult to remove
 - Incorporate surfactant

Salt Scrubs

- Non-aqueous gelling agents
 - Dextrin palmitate (Rheopearl KL)
 - Silica dimethyl silylate (Covasilic 15)
 - Fumed silica (Cab-o-Sil)
 - Hydrogenated castor oil
 - Aluminium stearate
 - Aluminum/magnesium hydroxide stearate
 - Quaternium-18 hectorite

Salt Scrubs

- Make it water-washable
 - PEG-40 Hydrogenated castor oil
 - Sodium cocoyl glutamate/Sodium stearoyl glutamate (Amisoft GS-11P)

Sources of Information

Sources of information

- Text books
- Magazines – SPC / C&T / IJCS /COSSMA
- Society of Cosmetic Scientists
 - Meetings, symposia and congresses
- In-Cosmetics & Formulate
- Web Sites
- Patents
- Suppliers and suppliers' web sites

Sources of information

- In-Cosmetics
 - Held every year in Spring in European City
 - <http://www.in-cosmetics.com/>
- Formulate
 - Held every year in Autumn in Ricoh Centre, Coventry
 - <http://www.scs.org.uk/scs-formulate-exhibition>

Society of Cosmetic Scientists

<http://www.scs.org.uk/>

- Monthly lectures
- Monthly magazine
- Annual symposium
- International Congress
- 1 week intensive course every 2 years
 - Principles & Practice of Cosmetic Science
- Distance learning course
 - <http://www.cosmeticlearning.com/>

Sources of information

- <http://www.cosmeticsandtoiletries.com/>
- <http://www.cosmeticsbusiness.com/>
- <http://www.happi.com/>
- <http://www.manufacturingchemist.com/>
- http://www.osmoz.com/index_Ing.asp
- <http://www.pca-on-line.com/index.htm?lang=eng>
- http://www.hair-science.com/_int/_en/index.aspx?rtlid=corporate
- http://www.skin-science.com/_int/_en/index.aspx
- <http://www.pgbeautygroomingscience.com/>
- <http://www.creative-developments.co.uk>

Sources of information

- <http://www.colipa.eu/about-colipa-the-european-cosmetic-cosmetics-association.html>
- <http://www.ctpa.org.uk/>
- <http://www.thefactsabout.co.uk/>
- http://ec.europa.eu/consumers/sectors/cosmetics/documents/directive/index_en.htm

Thank you for listening

John Woodruff

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