5.3 FORMULATION EXAMPLE: BALANCING GEL-CREAM SERUM WITH NIACINAMIDE



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# 5.3 FORMULATION EXAMPLE: BALANCING GEL-CREAM SERUM WITH NIACINAMIDE

#### In this lesson, we will cover:

- 1. Product development questions.
- 2. Formula.
- 3. Instructions.
- 4. Product specifications.
- 5. Application/usage instructions.

### **PRODUCT DEVELOPMENT QUESTIONS**

#### **Product type:**

Soft gel-cream serum.

# Are you formulating to meet a particular standard or certification?

We are using mainly natural ingredients, although some of the active ingredients (eg niacinamide) might not be permitted in certifications. Niacinamide is often used in natural cosmetics as it does exist in nature, but the ingredient is made synthetically. If you wish to adhere to Ecocert/ COSMOS standards, you can omit it.

#### Who is your target audience?

People of all ages who wish to balance sebum production.

#### What skin type is it for?

It is targeted at oily and acne-prone skin.



Above: Melissa hydrosol



Above: Grapeseed oil



Above: Niacinamide

#### What is the purpose/function of your product?

To balance sebum production, reduce skin oiliness, reduce acne formation and strengthen the skin barrier.

# What properties and qualities do you want your product to have?

Soft, white gel-cream, herbal scent, hydrating and non-oily skin feel.

### Packaging type and aesthetics.

Airless pump.

#### Which solvents are you using and why?

Rosemary and melissa hydrosol – soothing and balancing, ideal for oily skin.

#### Which emulsifiers are you using and why?

Ecogel – emulsifier for light gel-cream. It creates a silky texture, ideal for light, watery creams.

#### Which humectants are you using and why? Glycerin – inexpensive, easily available.

Which thickeners/stabilizers are you using and why? No other thickeners.

#### Which oils are you using and why?

Grapeseed oil – due to its linoleic acid content and lightweight skin feel; black seed oil – anti-microbial and anti-inflammatory; passionfruit seed oil – quick to absorb and very regenerative.

# Which active ingredients and/or essential oils are you using and why?

Niacinamide for sebum-regulating purposes, willow bark extract for exfoliation, tea tree essential oil for antimicrobial benefits and lemongrass essential oil for astringent properties.

# Which other ingredients specific to this product type are you using and why? Nothing else.



### ADDITIONAL NOTES REGARDING THE FORMULATION

This formulation is a gel-cream type of serum. Ecogel is our chosen emulsifier, which acts as both a thickener and emulsifier and creates a gel-cream texture. If you do not want to use this you could create a regular emulsion serum using an emulsifier plus a thickener.

The pH of the formulation needs to be 6.0, because this is where niacinamide is most stable. We are preserving the formula with Geogard 221, as it still has some activity at that pH. But just to be sure, we are using an airless pump for this product, to lower the potential for microbial contamination. An airless pump is also a nice option as this is not a firm, thick emulsion, but rather soft and jelly-like, so jars do not make ideal packaging.

## FORMULA

| Phase | INCI name   | Trade name                           | Function             | w/w% |
|-------|---|--------------------------------------|----------------------|------|
| А     | Glycerin  | Glycerin                             | Humectant            | 2.0  |
| А     | Lysolecithin (and) Sclerotium Gum<br>(and) Xanthan Gum (and) Pullulan | Ecogel                               | Thickener/emulsifier | 2.0  |
| В     | Rosmarinus Officinalis<br>(Rosemary) Water                            | Rosemary hydrosol                    | Solvent              | 42.6 |
| В     | Melissa Officinalis (Melissa) Water                                   | Melissa hydrosol                     | Solvent              | 40.0 |
| В     | Niacinamide   | Niacinamide (Vitamin B3)             |                      | 2.0  |
| В     | Glycerin, Aqua,<br>Salix Alba (Willow) Bark Extract                   | Willow bark extract                  | Active               | 2.0  |
| С     | Vitis Vinifera (Grape) Seed Oil                                       | Grapeseed oil                        | Emollient            | 3.0  |
| С     | Nigella Sativa Seed Oil   | Black seed oil                       | Emollient            | 3.0  |
| С     | Passiflora Incarnata Seed Oil   | Passionfruit seed oil                | Emollient            | 2.0  |
| С     | Tocopherol  | Vitamin E<br>(95% mixed tocopherols) | Antioxidant          | 0.1  |
| С     | Melaleuca Alternifolia<br>(Tea Tree) Leaf Oil                         | Tea tree essential oil               | Fragrance            | 0.1  |
| С     | Cymbopogon Schoenanthus<br>(Lemongrass) Oil                           | Lemongrass essential oil             | Fragrance            | 0.2  |
| D     | Dehydroacetic Acid, Benzyl Alcohol                                    | Geogard 221                          | Preservative         | 1.0  |

### INSTRUCTIONS

- 1. Mix together phase A ingredients to create a slurry.
- 2. Combine phase B ingredients and stir until all the solids are dissolved. You can gently heat the water (up to 40°C) to speed up the dissolving process.
- 3. Add phase A to phase B while mixing, then stir thoroughly or homogenize (with a stick blender/ homogenizer) for 10 minutes until the liquid thickens up.
- 4. Combine phase C ingredients and stir thoroughly.
- 5. Add phase C to phase A+B while stirring. Homogenize again, until a white emulsion forms.
- 6. Add phase D into the batch and stir thoroughly.
- 7. Adjust the pH to 6.0.

Optional: Record the amount of pH adjuster solution used. Calculate the amount of solid/pure pH adjuster used and amend your formula to include this. See **Lesson 0.5 Testing and adjusting pH**, for more information.

### **PRODUCT SPECIFICATIONS**

Appearance: Medium-thick gel.

Odor: Herbal, citrus.

Color: White/off-white.

**pH:** 5.39 before adjustments. We adjusted the pH to 6.08 with 5.61g of sodium hydroxide (a 10% solution).

## **APPLICATION/USAGE INSTRUCTIONS**

Apply a pea-sized amount to the face in the morning and evening, massage into the skin.



## SUMMARY

In this lesson we explored a formulation for a Balancing Gel-cream Serum with Niacinamide, we learned about the ingredients it includes and the manufacturing process.



# 5.4 FORMULATION EXAMPLE: TONING EYE SERUM WITH CAFFEINE



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# 5.4 FORMULATION EXAMPLE: TONING EYE SERUM WITH CAFFEINE

#### In this lesson, we will cover:

- 1. Product development questions.
- 2. Formula.
- 3. Instructions.
- 4. Product specifications.
- 5. Application/usage instructions.

#### **PRODUCT DEVELOPMENT QUESTIONS**

#### **Product type:**

Fluid emulsion serum.

# Are you formulating to meet a particular standard or certification?

We are using mainly natural ingredients, although some of the active ingredients (eg Syn-ake peptide and Japanese knotweed extract) might not be permitted in certifications. Many peptides are not permitted in certifications because they are made synthetically, even though they only contain naturally occurring building blocks (amino acids). Some suppliers of Japanese knotweed extract have COSMOS certify their product, but not all of them. The one we are using here is not COSMOS-approved.

#### Who is your target audience?

People aged 30 and above.

#### What skin type is it for?

It is suitable for all skin types and is targeted at skin that is showing signs of aging.

#### What is the purpose/function of your product?

To gently soften and moisturize the skin around the eyes, and also to tone and tighten fine lines on the skin.

#### What properties and qualities do you want your product to have?

Fluid emulsion that leaves the skin soft, hydrated and toned.

#### Packaging type and aesthetics.

Glass bottle with pipette closure.

#### Which solvents are you using and why?

Neroli hydrosol - it has astringent properties and a lovely scent.

#### Which emulsifiers are you using and why?

Imwitor 375 – it can be used in cold process emulsions, which is ideal for sensitive ingredients. It also creates low viscosity emulsions, perfect for serums.

#### Which humectants are you using and why?

Glycerin – inexpensive, easily available.

#### Which thickeners/stabilizers are you using and why?

Xanthan gum – easily available.

#### Which oils are you using and why?

Avocado oil as it is good for dry and mature skin; and squalane – a lightweight emollient and gentle occlusive.

#### Which active ingredients and/or essential oils are you using and why?

Caffeine – to increase the microcirculation; Japanese knotweed extract – for its resveratrol content to offer antioxidant benefits; green tea extract – for its antioxidant and astringent properties and Syn-ake peptide – for its temporary muscle relaxant properties to smooth expression lines. We are not using essential oils in order to lower the chances of causing any irritation, as skin around the eyes is very delicate.

#### Which other ingredients specific to this product type are you using and why?

Vitamin E as an antioxidant, Geogard 221 as a preservative.

5.4 Formulation example: Toning Eye Serum with Caffeine



### ADDITIONAL NOTES REGARDING THE FORMULATION

The eye area has very sensitive skin and for some people it can be easily irritated by the preservative or active ingredients in the product. It is difficult to say which ingredients can be irritating, as this differs from one person to another. We have not used any essential or fragrance oils in this formula in order to minimize the risk of irritation.

## FORMULA

| Phase | INCI name Trade nan   |                                      | Function     | <b>w/w</b> % |
|-------|---|--------------------------------------|--------------|--------------|
| А     | Glycerin  | Glycerin                             | Humectant    | 2.0          |
| А     | Xanthan Gum   | Xanthan gum                          | Thickener    | 0.3          |
| В     | Organic Citrus, Aurantium Amara Water   | Neroli hydrosol                      | Solvent      | 75.2         |
| В     | Caffeine  | Caffeine                             | Active       | 2.0          |
| В     | Butylene Glycol, Water, Polygonum<br>Cuspidatum Root Extract                  | Japanese knotweed extract            | Active       | 4.0          |
| В     | Glycerin (and) Water (and) Dipeptide<br>Diaminobutyroyl Benzylamide Diacetate | Syn-ake peptide                      | Active       | 4.0          |
| В     | Camellia Sinensis (Green Tea) Leaf Extract                                    | Green tea extract                    | Active       | 0.4          |
| С     | Squalane  | Squalane                             | Emollient    | 5.0          |
| С     | Persea Gratissima (Avocado) Oil   | Avocado oil                          | Emollient    | 4.0          |
| С     | Glyceryl/Citrate/Lactate/Linoleate/Oleate                                     | Imwitor 375                          | Emulsifier   | 2.0          |
| С     | Tocopherol  | Vitamin E<br>(95% mixed tocopherols) | Antioxidant  | 0.1          |
| D     | Dehydroacetic Acid, Benzyl Alcohol  | Geogard 221                          | Preservative | 1.0          |



Above: Syn-ake



Above: Glycerin

### INSTRUCTIONS

- 1. Mix together phase A ingredients to create a slurry.
- 2. Combine phase B ingredients and stir until all the solids are dissolved. You can gently heat the water (up to 40°C) to speed up the dissolving process.
- 3. Add phase A to phase B while mixing, then stir thoroughly or homogenize (with a stick blender/ homogenizer) until the liquid thickens up.
- 4. Combine phase C ingredients and stir thoroughly until homogenous.
- 5. Add phase C to phase A+B while stirring, and homogenize again until a white emulsion forms.
- 6. Add phase D to the emulsion, stir thoroughly.
- 7. Adjust the pH to 4.0-4.5.

Optional: Record the amount of pH adjuster solution used. Calculate the amount of solid/pure pH adjuster used and amend your formula to include this. See **Lesson 0.5 Testing and adjusting pH**, for more information.

## **PRODUCT SPECIFICATIONS**

Appearance: Thin emulsion.

Odor: Faintly citrus.

Color: Pale yellow/yellow.

**pH:** 5.41 before adjustments. We adjusted the pH to 4.11 with 0.8g of citric acid (a 50% solution).

## **APPLICATION/USAGE INSTRUCTIONS**

Apply one to two drops on the area around the eyes in the morning and evening, massage into the skin.



### SUMMARY

In this lesson we explored a formulation for a Toning Eye Serum with Caffeine which can reduce the appearance of fine lines around the eyes. We learned about the ingredients it includes and the manufacturing process. 5.5 FORMULATION EXAMPLE: ANTI-AGING NIGHT SERUM WITH VITAMIN A

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## 5.5 FORMULATION EXAMPLE: ANTI-AGING NIGHT SERUM WITH VITAMIN A

#### In this lesson, we will cover:

- 1. Product development questions.
- 2. Formula.
- 3. Instructions.
- 4. Product specifications.
- 5. Application/usage instructions.

#### **PRODUCT DEVELOPMENT QUESTIONS**

#### **Product type:**

Medium to low viscosity emulsion serum.

# Are you formulating to meet a particular standard or certification?

We are using mainly natural ingredients, although some of the active ingredients (eg Matrixyl peptide, Vitamin A and alpha lipoic acid) might not be permitted in certifications. Many peptides are not permitted in certifications because they are made synthetically, even though they only contain naturally occurring building blocks (amino acids). Vitamin A and alpha lipoic acid are both naturally occurring substances, but the pure forms are made synthetically.

#### Who is your target audience?

People aged 30 and above.

#### What skin type is it for?

It is suitable for all skin types and is targeted at skin that is starting to show signs of aging.



Above: Xyliance



Above: Guar gum

#### What is the purpose/function of your product?

To help replenish antioxidants in the skin, prevent collagen breakdown and to stimulate new collagen synthesis to keep the skin looking firm and youthful.

# What properties and qualities do you want your product to have?

Nighttime serum in the form of a soft emulsion that leaves the skin soft, hydrated and rejuvenated.

#### Packaging type and aesthetics.

Airless pump.

#### Which solvents are you using and why?

Water – inexpensive and easy to obtain; sandalwood hydrosol – for its anti-inflammatory properties and lovely scent.

#### Which emulsifiers are you using and why?

Xyliance – a naturally derived emulsifier that creates smooth, light emulsions.

#### Which humectants are you using and why?

Glycerin - inexpensive, easily available.

#### Which thickeners/stabilizers are you using and why?

Guar gum – easily available, non-sticky texture.

#### Which oils are you using and why?

Macadamia nut oil – regenerating and softening properties; wheatgerm oil – rich in vitamins, and has anti-aging properties due to antioxidant content; cacay oil – highest content of Vitamin A in natural carrier oils, and fractionated coconut oil – light and non-greasy emollient suitable for all skin types.



Above: Vitamin A palmitate

# Which active ingredients and/or essential oils are you using and why?

Vitamin A for its anti-aging and collagen synthesis-stimulating properties; alpha lipoic acid as a powerful antioxidant; pomegranate extract for its ellagic acid content to function as an antioxidant; grapeseed extract for its antioxidant capabilities and Matrixyl Synthe'6 to stimulate collagen production and rejuvenate skin.

# Which other ingredients specific to this product type are you using and why?

Vitamin E as an antioxidant; Preservative Eco as a preservative.

# ADDITIONAL NOTES REGARDING THE FORMULATION

This is a formulation for a nighttime serum filled with antioxidants for an anti-aging effect. To further enhance this effect, it also contains Vitamin A (both as a pure ingredient and naturally present in cacay oil) and Matrixyl peptide. The most sensitive ingredients are added in the cool-down phase. We chose an airless pump to protect the product from oxidation as much as possible.

Vitamin A and alpha lipoic acid are very sensitive to light, so this serum is intended to be used in the evening only.



5.5 Formulation example: Anti-aging Night Serum with Vitamin A



## **FORMULA**

| Phase | INCI name   | Trade name                           | Function            | <b>w/w</b> % |
|-------|---|--------------------------------------|---------------------|--------------|
| А     | Glycerin  | Glycerin                             | Humectant           | 2.00         |
| А     | Cyamopsis Tetragonoloba Gum   | Guar gum                             | Thickener           | 0.30         |
| В     | Aqua  | Aqua Purified water (deionized)      |                     | 38.40        |
| В     | Sodium Phytate (and) Aqua (and) Alcohol   | Dermofeel PA-3                       | Chelating agent     | 0.20         |
| В     | Santalum Album (Sandalwood) Water   | Sandalwood hydrosol                  | Solvent             | 25.00        |
| С     | Cetearyl Wheat Straw Glycosides<br>(and) Cetearyl Alcohol                             | Xyliance                             | Emulsifier          | 3.00         |
| с     | Macadamia Ternifolia Seed Oil   | Macadamia nut oil                    | Emollient           | 7.00         |
| С     | Triticum Vulgare (Wheat) Germ Oil   | Wheatgerm oil                        | Emollient           | 4.00         |
| с     | Caryodendron Orinocense Seed Oil  | Cacay oil                            | Emollient           | 3.00         |
| С     | Tocopherol  | Vitamin E<br>(95% mixed tocopherols) | Antioxidant         | 0.10         |
| D     | Caprylic/Capric Triglyceride  | Fractionated coconut oil             | Emollient           | 5.00         |
| D     | Helianthus Annuus Oil,<br>Retinyl Palmitate, Tocopherol                               | Vitamin A palmitate                  | Active              | 0.50         |
| D     | Thioctic Acid   | Alpha lipoic acid                    | Active, antioxidant | 1.50         |
| D     | Helichrysum Italicum Flower Oil   | Helichrysum essential oil            | Fragrance, active   | 0.50         |
| E     | Aqua  | Purified water (deionized)           | Solvent             | 6.00         |
| E     | Benzyl Alcohol (and) Salicylic Acid (and)<br>Glycerin (and) Sorbic Acid               | Preservative Eco                     | Preservative        | 1.00         |
| E     | Punica Granatum (Pomegranate) Extract   | Pomegranate extract                  | Active              | 0.25         |
| E     | Vitis Vinifera (Grape) Seed Extract   | Grapeseed extract                    | Active              | 0.25         |
| E     | Glycerin (and) Aqua (and) Hydroxypropyl<br>Cyclodextrin (and) Palmitoyl Tripeptide-38 | Matrixyl Synthe'6                    | Active              | 2.00         |

### INSTRUCTIONS

- 1. Mix together phase A ingredients to create a slurry.
- 2. Combine phase B ingredients and stir.
- 3. Add phase A to phase B while mixing, then stir thoroughly or homogenize (with a stick blender/homogenizer) until the liquid thickens up slightly.
- 4. Combine phase C ingredients.
- 5. Separately heat phases A+B and phase C to 70°C. To account for water evaporation during heating, weigh the container with phase A+B ingredients before heating and take note of the weight. Once phase A has reached the desired temperature, weigh the container again to see how much water evaporated. Add the appropriate amount of purified water to compensate for any water lost during heating.
- 6. Add phase C to phase A+B while stirring, and homogenize again until a white emulsion forms.
- 7. Combine phase D ingredients and phase E ingredients separately, stir until powders are dissolved.
- 8. After the emulsion cools down to below 40°C, mix in phase D and phase E.
- 9. Adjust the pH to 4.0-4.5.

Optional: Record the amount of pH adjuster solution used. Calculate the amount of solid/pure pH adjuster used and amend your formula to include this. See **Lesson 0.5 Testing and adjusting pH**, for more information.

### **PRODUCT SPECIFICATIONS**

Appearance: Low viscosity emulsion.

Odor: Faint floral.

**Color:** Pale pink/purple.

pH: 4.07. No adjustment necessary.

### **APPLICATION/USAGE INSTRUCTIONS**

Apply two to four drops on the face in the evening, massage into the skin.



## SUMMARY

In this lesson we explored a formulation for an Anti-aging Night Serum with Vitamin A, we learned about the ingredients it includes and the manufacturing process.

# 5.6 TROUBLESHOOTING EMULSION-BASED AND GEL-CREAM SERUMS

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# 5.6 TROUBLESHOOTING EMULSION-BASED AND GEL-CREAM SERUMS

In this lesson, we will cover:

- 1. Common problems you may encounter when making emulsion-based serums and how to solve them.
- 2. Common problems you may encounter when making gel-cream serums and how to solve them.



Advanced Certificate in High-Performance Serum Formulation

## COMMON PROBLEMS YOU MAY ENCOUNTER WHEN MAKING EMULSION-BASED SERUMS AND HOW TO SOLVE THEM

#### MY SERUM SEPARATES, WHAT CAN I DO?

In Lesson 5.2 Creating emulsions, we talked about the three steps to successful emulsification: chemical, heat and mechanical. It is important to check you have each of these steps covered.

#### **1.** Check you are using an all-in-one or complete emulsifier.

Check that the emulsifier you are using is a complete or all-in-one emulsifier. Check with the supplier or look back at **Lesson 5.2 Creating emulsions**. Some emulsifiers are much easier to work with than others, so if you are still having problems we recommend trying a different one. Beeswax and cetyl alcohol are not emulsifiers.

#### 2. Check you are using the emulsifier at the correct quantity.

Try increasing the quantity by 1-2%. Also check the size of your oil phase; the larger your oil phase, the more emulsifier you will require. There will be a limit to how big your oil phase can be, often around 25% of your recipe/formula, although you will need to check what this is for your emulsifier, as it can vary.

#### 3. Add a thickener/stabilizer.

Try adding 0.2-0.3% xanthan gum in the water phase and/or a co-emulsifier or thickener in the oil phase (eg 1-2% glyceryl stearate or cetyl alcohol). If you are already using one, try increasing the amount. If you are just using one in the oil phase, include xanthan gum in the water phase too, and vice versa.

#### 4. Mix the two phases together well with an electric stick blender.

If you have been mixing by hand with a hand whisk, change to an electric stick blender.

#### 5. Check that you have put the correct ingredients in the correct phase.

Oil soluble in the oil phase, water soluble in the water phase.

6. Check the oil and water phase are at the same temperature before they are mixed together and that the oil and water phase are at the temperature recommended by the manufacturer of your chosen emulsifier.

#### 7. Check your emulsifier for any special instructions for use.

This includes checking the pH range it will work within.

#### 8. Some preservatives can also destabilize creams!

Geogard Ultra (INCI: Gluconolactone (and) Sodium Benzoate) can destabilize fragile emulsions.

#### 9. Check the electrolyte tolerance of your emulsifier.

If you are experiencing emulsion instability when using ingredients that contain electrolytes (eg aloe vera juice, salt), check what the electrolyte tolerance of your emulsifier is. If it has low tolerance, you might need to either remove problematic ingredients from the recipe or use a different emulsifier.

#### 10. Use a blend of emulsifiers

Commercially available emulsifiers either come as single emulsifying agents or blends of two or more emulsifying ingredients. Often they also contain a fatty alcohol that thickens and stabilizes the emulsion. The blends that combine two emulsifying agents will often create more stable emulsions as each emulsifier has its own qualities and abilities. If you have trouble with stability you can change to an emulsifier blend that combines two emulsifying agents together, or you can pair up two emulsifiers.

#### MY SERUM IS TOO THIN, WHAT CAN I DO?

#### 1. Check the emulsion has cooled to room temperature.

An emulsion will thicken naturally until it reaches room temperature. The warmer it is, the thinner or runnier it will be. Most emulsions will thicken once they reach room temperature, but some will reach their final consistency after 24 hours.

#### 2. Adjust the amount of emulsifier used.

Check the suggested usage rates with your supplier and/or Lesson 2.4.3 Functional ingredients: natural emulsifiers, and increase the amount used in your recipe/formula.

#### 3. Add a thickener.

If you wish to create a thicker cream, 1-2% of cetyl alcohol may be added to the oil phase (the amount of carrier oils should be reduced by the same amount).

# 4. With some emulsifiers, including Xyliance and Olivem 1000, the method of mixing affects the viscosity (thickness) of the product.

High-speed mixing (homogenizer, stick blender) creates thicker creams, low-speed mixing (hand whisk) creates thinner creams and lotions.

#### MY SERUM IS TOO THICK, WHAT CAN I DO?

#### **1.** Check the percentage of emulsifier you used.

Check the suggested usage rates with your supplier and/or Lesson 2.4.3 Functional ingredients: natural emulsifiers. Decrease the amount used in your recipe/formula.

#### 2. Use less thickener.

#### 3. Does your recipe include a butter or wax?

These will produce a thickening effect so try reducing the amount or replacing them with a liquid oil instead.

# 4. With some emulsifiers, including Xyliance and Olivem 1000, the method of mixing affects the viscosity (thickness) of the product.

High-speed mixing (homogenizer, stick blender) creates thicker creams, low-speed mixing (hand whisk) creates thinner creams and lotions.



Advanced Certificate in High-Performance Serum Formulation

# COMMON PROBLEMS YOU MAY ENCOUNTER WHEN MAKING GEL-CREAM SERUMS AND HOW TO SOLVE THEM.

#### MY GEL-CREAM SERUM SEPARATES, WHAT CAN I DO?

Emulsifiers that create gel-creams are usually able to emulsify lower quantities of oil than regular emulsifiers. If you are experiencing separation, make sure you have not included too high a percentage of oils in your formulation. Check the supplier's guidelines regarding the size of the oil phase and the quantity of emulsifier needed.

The manufacturing process also plays an important role in emulsion stability. Polymer emulsifiers require longer periods of homogenizing to create a stable gel-cream. Check the supplier's guidelines regarding the optimal manufacturing process.

### MY GEL-CREAM IS TOO THIN, WHAT CAN I DO?

Polymeric emulsifiers have different thickening abilities, and the resulting emulsion might have a lower viscosity than you wanted. Since gel-creams usually do not contain a heated oil phase, adding lipophilic thickeners, like cetyl alcohol, is not an option. If you wish to include lipid thickeners, you will need to change the manufacturing process to include a heating step (both water and oil phases need to be heated). If you wish to follow a cold process method, you will need to use gums or other aqueous thickeners, like xanthan gum or konjac gum. Disperse them in your water phase.

### SUMMARY

In this lesson we looked at three common issues you may encounter when creating emulsion-based serums and two issues you may encounter when creating gel-cream serums and how to solve them.



5.7 LABORATORY TEST REPORTS: EMULSION-BASED AND GEL-CREAM SERUMS

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# 5.7 LABORATORY TEST REPORTS: EMULSION-BASED AND GEL-CREAM SERUMS

#### In this lesson, we will cover:

- 1. Interpreting challenge test results.
- 2. Preservative Efficacy Test results for our emulsionbased and gel-cream serum formulas.

If you are interested in the reports from the PETs we had carried out on formulas featured in this module you can find them in this lesson.

Please note: The results and reports only apply to the samples that we made and had tested. These reports are not transferable to products made by anyone else as your manufacturing conditions and ingredients will be different. You cannot use these reports as part of your product documentation.

### **INTERPRETING CHALLENGE TEST RESULTS**

#### THE CHALLENGE TEST

In order to ensure your product is safe to use and store, you must submit it for experimental assessments. These tests will reveal whether the product displays microbial stability and effective preservation during its shelf-life.

Challenge testing checks how effective a preservative system is and whether it is capable of withstanding contamination. It simulates a consumer's use and storage of the product, at room temperature, by contaminating the finished cosmetic product. Calibrated inocula incorporates relevant strains of microorganisms into the product, which is then monitored. The reaction of the product allows you to evaluate the adequacy of its preservation.

After the product has been contaminated, the number of surviving microorganisms in the mixture is recorded at predetermined intervals over a 28 day period. For each time and strain, a log reduction value is calculated. This figure is compared to the minimum values required to pass the test.

There are various protocols for challenge tests (ISO standard and European Pharmacopoeia are commonly used), and most of the protocols utilize the microorganisms listed below. However, some protocols use additional species. For a comparison of two protocols, please see: <u>www.teknoscienze</u>. <u>com/Contents/Riviste/PDF/HPC2\_2013\_RGB\_34-41.pdf</u>

The following strains of microorganisms are most commonly used to contaminate the samples:

- Pseudomonas aeruginosa.
- Staphylococcus aureus.
- Candida albican.
- Aspergillus brasiliensis (previously A. niger).



#### Log reductions

The difference of CFUs (Colony Forming Unit; it basically means 'viable microorganisms') – if any – between the start and the time of recordings (ie at 14 and 28-day intervals) determines whether the preservative system is working properly. This is then stated as a log reduction.

The larger the log reduction, the more effective the product's preservation properties.

In order to pass the challenge test, both of the following requirements have to be met:

- 1. A 2 log reduction in the number of microorganisms, after 14 days, compared to the count at the start of testing.
- 2. A 0.5 log reduction in the number of microorganisms, after 28 days, compared to the count after 14 days<sup>1</sup>.

It is key that the log reduction meets these minimum values.

#### Interpretation of log reductions<sup>2</sup>

| Log reduction | Number of CFUs | Percentage reduction (%) | Times smaller |
|---------------|----------------|--------------------------|---------------|
| 0 log (Log0)  | 1,000,000      | 0                        | N/A           |
| 1 log (Log1)  | 100,000        | 90                       | X10           |
| 2 log (Log2)  | 10,000         | 99                       | X100          |
| 3 log (Log3)  | 1,000          | 99.9                     | X1,000        |
| 4 log (Log4)  | 100            | 99.99                    | X10,000       |
| 5 log (Log5)  | 10             | 99.999                   | X100,000      |
| 6 log (Log6)  | 1              | 99.9999                  | X1,000,000    |

#### **Represented graphically:**



To better demonstrate a log reduction, below is one of our creams which has passed the preservative efficacy test with a high level of log reduction<sup>3</sup>.

## FRANKINCENSE FACE CREAM FOR MATURE SKIN WITH COENZYME Q10

#### Formula

| Phase | INCI name                               | Trade name                           | Function                                   | w/w%  |
|-------|---|--------------------------------------|--|-------|
| А     | Aqua                                    | Purified water (deionized)           | Solvent                                    | 66.85 |
| Al    | Gluconolactone (and) Sodium Benzoate    | Geogard Ultra                        | Preservative                               | 1.00  |
| A2    | Aloe Barbadensis Leaf Juice Powder      | Aloe vera powder 200:1               | Humectant, soothing                        | 0.05  |
| A2    | Hydrolyzed Wheat Protein                | Hydrolyzed wheat protein             | Humectant, skin conditioning               | 2.00  |
| A2    | Sodium Phytate (and) Aqua (and) Alcohol | Dermofeel PA-3                       | Chelating agent                            | 0.10  |
| A3    | Glycerin                                | Clycerin                             | Humectant                                  | 2.00  |
| A3    | Xanthan Gum                             | Xanthan gum                          | Thickener                                  | 0.20  |
| В     | Butyrospermum Parkii (Shea Butter)      | Shea butter                          | Emollient                                  | 4.00  |
| В     | Triticum Vulgare (Wheat) Germ Oil       | Wheatgerm oil                        | Emollient                                  | 4.00  |
| В     | Rosa Canina Fruit Oil                   | Rosehip oil                          | Emollient                                  | 3.00  |
| В     | Cetyl Alcohol                           | Cetyl alcohol                        | Thickener, stabilizer                      | 2.00  |
| В     | Cetearyl Olivate (and) Sorbitan Olivate | Olivem 1000                          | Emulsifier                                 | 6.00  |
| С     | Squalane (Olive)                        | Squalane                             | Water loss prevention,<br>anti-aging       | 5.00  |
| С     | Ubiquinone                              | Coenzyme Q10<br>(pure powdered form) | Active, antioxidant                        | 1.00  |
| D     | Potassium Sorbate                       | Potassium sorbate                    | Preservative booster                       | 0.20  |
| D     | Boswellia Carterii (Frankincense) Oil   | Frankincense essential oil           | Fragrance, active                          | 0.50  |
| D     | Tocopherol                              | Vitamin E<br>(95% mixed tocopherols) | Antioxidant                                | 0.10  |
| D     | Panthenol                               | D panthenol                          | Humectant, moisturizing, cell regeneration | 2.00  |

| Test Strains:            |      |       | Total viable counts per g of produ | uct |
|--------------------------|------|-------|------------------------------------|-----|
| Staphylococcus aureus    | ATCC | 6538  | 152000                             |     |
| Pseudomonas aeruginosa   | ATCC | 9027  | 161000                             |     |
| Candida albicans         | ATCC | 10321 | 88000                              |     |
| Aspergillus brasiliensis | ATCC | 16404 | 97000                              |     |

#### Procedure

1. The sample was inoculated with the reference inocula according to the test method above.

2. Total viable counts were performed at 7,14 and 28 days after inoculation.

#### Results after inoculation

| Test Strains:                  |            |           | Colony forming units (CFU) per g |              |            |  |
|--------------------------------|------------|-----------|----------------------------------|--------------|------------|--|
|                                |            | Inoculum  | 7 Days                           | 14 Days      | 28 Days    |  |
| Staphylococcu                  | is aureus  | 152000    | 0                                | 0            | (          |  |
| Pseudomonas                    | aeruginosa | 161000    | 0                                | 0            | (          |  |
| Candida albicans 88000         |            |           | 0                                | 0            | (          |  |
| Aspergillus brasiliensis 97000 |            |           | 12                               | 0            | (          |  |
| Test Strains:                  |            | Logarithm | nic decrease of                  | plate counts | Result     |  |
|                                |            | 7 Days    | 14 Days                          | 28 Days      | ISO 11930* |  |
| Staphylococcu                  | is aureus  | 5.182     | 5.182                            | 5.182        | A, NIL     |  |
| Pseudomonas aeruginosa         |            | 5.207     | 5.207                            | 5.207        | A, NIL     |  |
| Candida albica                 | ans        | 4.944     | 4.944                            | 4.944        | A, NIL     |  |
| Aspergillus bra                | asiliensis | 3 908     | 4 987                            | 4,987        | A NIL      |  |

#### Interpretation of results:

The **first highlighted area** shows the change in the colonies: there are 12 colonies of *Aspergillus brasiliensis* after seven days of inoculation.

The **second highlighted area** represents how the 12 colonies of *A. brasiliensis* affected the plate count (the number of actively growing cells) after seven days of inoculation. The increase from 3.908 to 4.987 reflects a decrease of 12 CFUs between the 7 and 14 day report in plate counts of *A. brasiliensis*.

Overall, the study report from the lab indicates a 5 log reduction, which corresponds to a percent reduction between 99.999 and 99.99, which is a high pass, also known as an 'A' pass.

As you will see on the following pages, all of the gel-based formulas included in this module passed preservative efficacy testing with an A pass as indicated by A, NIL in the last row of the final column of each test report.

### PRESERVATIVE EFFICACY TEST RESULTS FOR OUR EMULSION-BASED AND GEL-CREAM SERUM FORMULAS

#### **Balancing Gel-cream Serum with Niacinamide**

#### Preservative Efficacy Testing

Test in analogy to ISO 11930 2.013-05-01 Test performed for: Customer:

Material Tested: SER5309

| ID:                    | OB PET 2962  |      |       | Date:       | 10/08/2021                |
|------------------------|--------------|------|-------|-------------|---------------------------|
| Test Strain            | ns:          |      |       | Total viabl | e counts per g of product |
| Staphylococcus aureus  |              | ATCC | 6538  |             | 6,410,000                 |
| Pseudomonas aeruginosa |              | ATCC | 9027  |             | 5,490,000                 |
| Candida al             | lbicans      | ATCC | 10321 |             | 198,000                   |
| Aspergillus            | brasiliensis | ATCC | 16404 |             | 485,000                   |

#### Procedure

1. The sample was inoculated with the reference inocula according to the test method above.

2. Total viable counts were performed at 7,14 and 28 days after inoculation.

#### Results after inoculation

| Test Strains:            | Colony forming units (CFU) per g |                 |           |            |
|--------------------------|----------------------------------|-----------------|-----------|------------|
|                          | Inoculum                         | 7 Days          | 14 Days   | 28 Days    |
| Staphylococcus aureus    | 6,410,000                        | 0               | 0         | 0          |
| Pseudomonas aerugino     | sa 5,490,000                     | 0               | 0         | 0          |
| Candida albicans         | 198,000                          | 0               | 0         | 0          |
| Aspergillus brasiliensis | 485,000                          | 0               | 0         | 0          |
| Test Strains:            | Logarithmic de                   | ecrease of plat | te counts | Result     |
|                          | 7 Days                           | 14 Days         | 28 Days   | ISO 11930* |
| Staphylococcus aureus    | 6.807                            | 6.807           | 6.807     | A, NIL     |
| Pseudomonas aerugino     | sa 6.740                         | 6.740           | 6.740     | A, NIL     |
| Candida albicans         | 5.297                            | 5.297           | 5.297     | A, NIL     |
| Aspergillus brasiliensis | 5.686                            | 5.686           | 5.686     | A, NIL     |

#### \*Criteria A

The microbiological risk is considered to be tolerable (the cosmetic product is protected against microbial proliferation that may present a potential risk for the user) and the cosmetic product is deemed to meet the requirements ISO 11930.

#### Criteria B

The microbiological risk analysis demonstrates the existence of control factors not related to the formulation; for example, a protective package such as a pump provides a higher level of protection than a jar (see Annex D, ISO 11930). This would be considered a protective device for risk reduction.

#### The resulting criteria were obtained by the calculation method laid down in ISO 11930 2013-5-1.

#### Conclusion

The results apply only to the sample tested. When assessed against the ISO 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for the Efficacy of Antimicroteal Preservation Test.

### PRESERVATIVE EFFICACY TEST RESULTS FOR OUR EMULSION-BASED AND GEL-CREAM SERUM FORMULAS

#### **Toning Eye Serum with Caffeine**

| Test in analogy to ISO 1193  | Preservati   | ive Efficacy Tes   | ting   |                             |
|--|--|--|--|-----------------------------|
| Test in analogy to ISO 1193  | Preservati   | ive Efficacy Tes   | ting   |                             |
| Test in analogy to ISO 1193  | Preservat  | ive Efficacy Tes   | fina   |                             |
| Test in analogy to ISO 1193  | Preservati   | ive Efficacy Tes   | tion   |                             |
| Test in analogy to ISO 11930   |  |  | Surra  |                             |
|  | 0 2.013-05-01  |  |  |                             |
| Test performed for:  |  |  |  |                             |
| Customer:  |  |  |  |                             |
| Material Tested:   | SER5410  |  |  |                             |
| Allowed the second s  |  |  |  |                             |
|  |  |  |  |                             |
| ID: <u>OB PET 2965</u>   |  | Dat  | te: 11/08/20   | 021                         |
| Test Strains:  |  | Tot  | al viable counts per g   | of product                  |
| Stanhylococcus aureus  | ATCC   | 6538   | 0.440.00   |                             |
| oraphylococcus dureds  |  |  | 6,410,00   | 00                          |
| Pseudomonas aeruginosa   | ATCC   | 9027   | 5,490,00   | 00                          |
| Pseudomonas aeruginosa<br>Candida albicans   | ATCC<br>ATCC   | 9027<br>10321  | 5,490,00<br>198,000  | 00<br>00                    |
| Pseudomonas aeruginosa<br>Candida albicans<br>Aspergillus brasiliensis   | ATCC<br>ATCC<br>ATCC   | 9027<br>10321<br>16404   | 5,490,00<br>5,490,00<br>198,000<br>485,000   | 00                          |
| Pseudomonas aeruginosa<br>Candida albicans<br>Aspergillus brasiliensis<br>Procedure  | ATCC<br>ATCC<br>ATCC   | 9027<br>10321<br>16404   | 5,490,00<br>5,490,00<br>198,000<br>485,000   | 00                          |
| Pseudomonas aeruginosa<br>Candida albicans<br>Aspergillus brasiliensis<br>Procedure<br>1. The sample was inoculate   | ATCC<br>ATCC<br>ATCC<br>at with the reference  | 9027<br>10321<br>16404<br>ce inocula accordi   | 5,410,00<br>5,490,00<br>198,000<br>485,000<br>ng to the test method a  | 00<br>00<br>above.          |
| Pseudomonas aeruginosa<br>Candida albicans<br>Aspergillus brasiliensis<br>Procedure<br>1. The sample was inoculate<br>2. Total viable counts were p  | ATCC<br>ATCC<br>ATCC<br>ad with the reference<br>performed at 7,14 at                                      | 9027<br>10321<br>16404<br>ce inocula accordi<br>and 28 days after  | 5,490,00<br>5,490,00<br>198,000<br>485,000<br>ng to the test method a<br>inoculation.  | 00<br>00<br>above.          |
| Pseudomonas aeruginosa<br>Candida albicans<br>Aspergillus brasiliensis<br>Procedure<br>1. The sample was inoculate<br>2. Total viable counts were p<br>Results after inoculation   | ATCC<br>ATCC<br>ATCC<br>ATCC<br>ad with the reference<br>performed at 7,14 a                               | 9027<br>10321<br>16404<br>ce inocula accordi<br>and 28 days after  | 5,410,00<br>5,490,00<br>198,000<br>485,000<br>485,000<br>ng to the test method a<br>inoculation.                               | 00<br>00<br>above.          |
| Pseudomonas aeruginosa<br>Candida albicans<br>Aspergillus brasiliensis<br>Procedure<br>1. The sample was inoculate<br>2. Total viable counts were p<br>Results after inoculation<br>Test Strains:  | ATCC<br>ATCC<br>ATCC<br>ad with the reference<br>performed at 7,14 a                                       | 9027<br>10321<br>16404<br>ce inocula accordi<br>and 28 days after<br>Colony forming un                     | 5,410,00<br>5,490,00<br>198,000<br>485,000<br>485,000<br>inoculation.  | 00<br>00<br>above.          |
| Pseudomonas aeruginosa<br>Candida albicans<br>Aspergillus brasiliensis<br>Procedure<br>1. The sample was inoculate<br>2. Total viable counts were p<br>Results after inoculation<br>Test Strains:  | ATCC<br>ATCC<br>ATCC<br>ad with the reference<br>performed at 7,14 a                                       | 9027<br>10321<br>16404<br>ce inocula accordi<br>and 28 days after<br>Colony forming un<br>7 Days           | 5,410,00<br>5,490,00<br>198,000<br>485,000<br>485,000<br>inoculation.<br>nits (CFU) per g<br>14 Days                           | 00<br>00<br>above.<br>28 Da |
| Pseudomonas aeruginosa<br>Candida albicans<br>Aspergillus brasiliensis<br>Procedure<br>1. The sample was inoculate<br>2. Total viable counts were p<br>Results after inoculation<br>Test Strains:<br>Staphylococcus aureus                           | ATCC<br>ATCC<br>ATCC<br>ad with the reference<br>performed at 7,14 a<br>Inoculum<br>6,410,000              | 9027<br>10321<br>16404<br>ce inocula accordi<br>and 28 days after<br>Colony forming un<br>7 Days<br>0      | 6,410,00<br>5,490,00<br>198,000<br>485,000<br>ng to the test method a<br>inoculation.<br>nits (CFU) per g<br>14 Days<br>0      | 00<br>00<br>above.<br>28 Da |
| Pseudomonas aeruginosa<br>Candida albicans<br>Aspergillus brasiliensis<br>Procedure<br>1. The sample was inoculate<br>2. Total viable counts were p<br>Results after inoculation<br>Test Strains:<br>Staphylococcus aureus<br>Pseudomonas aeruginosa | ATCC<br>ATCC<br>ATCC<br>ad with the reference<br>performed at 7,14 a<br>Inoculum<br>6,410,000<br>5,490,000 | 9027<br>10321<br>16404<br>ce inocula accordi<br>and 28 days after<br>Colony forming un<br>7 Days<br>0<br>0 | 5,410,00<br>5,490,00<br>198,000<br>485,000<br>ng to the test method a<br>inoculation.<br>nits (CFU) per g<br>14 Days<br>0<br>0 | 00<br>00<br>above.<br>28 Da |

| Aspergillus brasiliensis | 485,000        | 0               | 0         |            | 0 |
|--------------------------|----------------|-----------------|-----------|------------|---|
| Test Strains:            | Logarithmic de | ecrease of plai | te counts | Result     |   |
|                          | 7 Days         | 14 Days         | 28 Days   | ISO 11930* |   |
| Staphylococcus aureus    | 6.807          | 6.807           | 6.807     | A, NIL     |   |
| Pseudomonas aeruginosa   | 6.740          | 6.740           | 6.740     | A, NIL     |   |
| Candida albicans         | 5.297          | 5.297           | 5.297     | A, NIL     |   |
| Aspergillus brasiliensis | 5.686          | 5.686           | 5.686     | A, NIL     |   |

#### \*Criteria A

The microbiological risk is considered to be tolerable (the cosmetic product is protected against microbial proliferation that may present a potential risk for the user) and the cosmetic product is deemed to meet the requirements ISO 11930.

#### Criteria B

The microbiological risk analysis demonstrates the existence of control factors not related to the formulation, for example, a protective package such as a pump provides a higher level of protection than a jar (see Annex D, ISO 11930). This would be considered a protective device for risk reduction.

#### The resulting criteria were obtained by the calculation method laid down in ISO 11930 2013-5-1.

#### Conclusion

The results apply only to the sample tested. When assessed against the ISO 11930 criteria for topical products, this sample meets the current ISO 11930 criteria for the Efficacy of Antimicrotical Preservation Test.

#### PRESERVATIVE EFFICACY TEST RESULTS FOR OUR EMULSION-BASED AND GEL-CREAM SERUM FORMULAS

#### Anti-aging Night Serum with Vitamin A

#### **Preservative Efficacy Testing** Test in analogy to ISO 11930 2.013-05-01 Test performed for: Customer: Material Tested: SER 5511 ID: **OB PET 2959** Date: 10/08/2021 Test Strains: Total viable counts per g of product ATCC 6538 6,410,000 Staphylococcus aureus Pseudomonas aeruginosa ATCC 9027 5,490,000

Procedure

Candida albicans Aspergillus brasiliensis

1. The sample was inoculated with the reference inocula according to the test method above.

10321

16404

198,000

485,000

2. Total viable counts were performed at 7,14 and 28 days after inoculation.

ATCC

ATCC

#### Results after inoculation

| Test Strains:            | Colony formin | Colony forming units (CFU) per g |           |            |  |
|--------------------------|---------------|----------------------------------|-----------|------------|--|
|                          | Inoculum      | 7 Days                           | 14 Days   | 28 Days    |  |
| Staphylococcus aureu     | 6,410,00      | 0 00                             | 0         | 0          |  |
| Pseudomonas aerugin      | osa 5,490,00  | 0 0                              | 0         | 0          |  |
| Candida albicans         | 198,00        | 0 0                              | 0         | 0          |  |
| Aspergillus brasiliensis | 485,00        | 0 0                              | 0         | 0          |  |
| Test Strains:            | Logarithmic   | decrease of pla                  | te counts | Result     |  |
|                          | 7 Days        | 14 Days                          | 28 Days   | ISO 11930* |  |
| Staphylococcus aureu     | s 6.80        | 6.807                            | 6.807     | A, NIL     |  |
| Pseudomonas aerugin      | osa 6.74      | 6.740                            | 6.740     | A, NIL     |  |
| Candida albicans         | 5.29          | 5.297                            | 5.297     | A, NIL     |  |
| Aspergillus brasiliensis | 5.68          | 5.686                            | 5.686     | A, NIL     |  |

#### \*Criteria A

The microbiological risk is considered to be tolerable (the cosmetic product is protected against microbial proliferation that may present a potential risk for the user) and the cosmetic product is deemed to meet the requirements ISO 11930.

#### Criteria B

The microbiological risk analysis demonstrates the existence of control factors not related to the formulation; for example, a protective package such as a pump provides a higher level of protection than a jar (see Annex D, ISO 11930). This would be considered a protective device for risk reduction.

#### The resulting criteria were obtained by the calculation method laid down in ISO 11930 2013-5-1.

#### Conclusion

The results apply only to the sample tested. When assessed against the ISO 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, the sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, this sample meets the current ISC 11930 criteria for topical products, the current ISC 11930 criteria for topi



## SUMMARY

In this lesson we shared with you the PET reports for formulas presented in this module. These are for your learning only and cannot be used as part of your product documentation.

#### REFERENCES

- 1. https://oxfordbiosciences.com/challenge-testing
- 2. https://www.endurocide.com/news/understanding-the-role-of-effective-disinfection-in-infection-control/
- 3. https://microchemlab.com/information/log-and-percent-reductions-microbiology-and-antimicrobial-testing