SCHOOL of NATURAL SKINCARE International

3.5 FORMULATING MASCARA

3.5 FORMULATING MASCARA

In this lesson, we will cover:

1. How to formulate mascara.
2. Examples on the market.
3. Formulation template for mascara.
4. Formulation example for beginners' mascara.
5. Formulation example for advanced mascara.
6. Adjusting the formula.
7. Pigment mixtures.
8. PET results.

Above: Acacia senegal gum

In natural mascaras, acacia gum is used as a film-former to improve the staying power and reduce smudging.

HOW TO FORMULATE AND MAKE MASCARA

Mascara as a product type is an **emulsion** that usually contains a high amount of waxes to make it very thick, and contains a water phase, an oil phase and an emulsifier. The oil phase can consist of just waxes, or a combination of oils and waxes. The water phase usually contains water-phase thickeners (eg xanthan gum) and film-formers (eg acacia gum). Oil-in-water (O/W) emulsifiers are used in mascaras, which means most commonly used emulsifiers are suitable for use in mascaras. As mascaras contain waxes, they require a hot manufacturing process, so normally hot-process emulsifiers are used, since they also function as thickeners.

Because of the high amount of wax in the formula, mascara can be tricky to make, since it has a very high viscosity as soon as it starts to cool down. When making a mascara, it is important to have all of your ingredients and equipment prepared and you should be ready to work fast.

Besides basic emulsion ingredients, mascara can also contain a film-former – natural (or synthetic) polymers that create a protective film on the lashes. They will improve the staying power of the mascara and make the mascara somewhat smudge-proof. In natural products, acacia gum (gummi arabicum, acacia senegal gum) is used for this purpose, as it does not increase viscosity further, even when used at high percentages. Commercial non-natural products usually use very strong synthetic polymers (such as acrylates copolymer) that provide long-lasting and waterproof effects.

Alcohol can be added to the formula because it is a very volatile solvent, which will make the mascara dry quicker after application. At concentrations up to 10% it usually does not cause any irritation.

Some mascaras contain thin fibers (usually cellulose-based, eg cellulose or synthetic) to give more length to the lashes. Insoluble powders, such as mica, silica or even clay can be added to a mascara formula to create a volumizing effect.

Different types of pigments can be used to add color to mascaras – most commonly dark matte pigments are used, such as black or dark brown.

Fragrances can be added to mascara, but since the product is applied so close to the eyes, it is usually a better idea to avoid them to prevent any irritation. Since the product contains an oil phase, solubilizers are not required.

Mascaras are normally packaged in small bottles (10-15ml) with a brush applicator attached to the closure. The brush is used to apply the product to the lashes, so no other tools are needed to use the mascara. Most mascara packaging comes with either a nylon brush or a silicone brush.

Since mascaras contain water, they need to contain preservatives. Because the product is used close to the eyes, any kind of microbial contamination could result in an eye infection, so it is very important to use a broad-spectrum preservative to preserve eye products. Creating a full broad-spectrum preservative system by using a preservative booster and/or chelating agent in addition to a preservative blend is a good idea. At the same time, we need to make sure none of these ingredients irritate the eye.

EXAMPLES ON THE MARKET

INIKA ORGANIC BOLD LASH VEGAN MASCARA

£27 per 12ml

https://uk.inikaorganic.com

Product highlights/description:

"Dramatically amplify lashes with this buildable, deeply pigmented formula. The Bold Lash Mascara glides on smoothly, instantly amplifying lashes to appear thicker-than-ever and dramatic in a single swipe. Achieve a voluminous appearance, whilst protecting lashes with the benefits of Certified Organic Magnolia Bark, Vitamin E and Sunflower Oil."

INCI: Aqua (Water), Copernicia Cerifera (Carnauba) Wax, Stearic Acid, Ricinus Communis (Castor) Seed Oil, Propanediol, Pentylene Glycol (Sugar Cane), Glyceryl Stearate SE, C-10-18 Triglycerides, Tocopherol (Vitamin E), Honokiol (Magnolia Bark Extract), Helianthus Annuus (Sunflower) Seed Oil, Xanthan Gum, Sodium Hydroxide, Galactoarabinan, Iron Oxide (CI 77499).

Our analysis:

This mascara uses water as the water-phase solvent, and Glyceryl Stearate SE as the emulsifier. The oil phase contains castor oil (for better pigment dispersion) and C-10-18 triglycerides (similar consistency to vegetable butters). The thickeners used include carnauba wax and stearic acid. The product is preserved with magnolia bark extract and the antioxidant used is Vitamin E. It uses black iron oxide to achieve a strong pigmentation.

ODYLIQUE ORGANIC MASCARA

£17.5 per 7ml

https://odylique.co.uk

Product highlights/description:

"With smooth and fast-drying application, our organic mascara is packed with conditioning plant extracts like aloe vera, calendula and sea buckthorn fruit to beautifully define, separate and care for your lashes. Free from synthetic chemicals including solvents, fibers and plasticisers, they are also extremely gentle – suitable for sensitive eyes and contact lens wearers. Available in rich black and brown shades to create naturally seductive lashes with great wearability."

INCI: Aqua, Alcohol, Cera Alba, Calendula Officinalis Flower Extract, Acacia Senegal Gum, Theobroma Cacao Seed Butter, Euphorbia Cerifera Cera, Lecithin, Sodium Olivate, Helianthus Annuus Seed Cera, Aloe Barbadensis Leaf Juice Powder, Hippophae Rhamnoides Fruit Extract, Lavandula Hybrida Oil, Linalool. May contain +/- CI 77007, CI 77491, CI 77499 + Silica.

Our analysis:

This product uses water, alcohol and aloe vera juice as the basis for the water phase. The oil phase consists of cocoa butter and two waxes: candelilla wax and sunflower wax. It also contains nourishing extracts of calendula and sea buckthorn, as well as lavandin essential oil. It uses lecithin and saponified olive oil as emulsifiers. Since no preservatives are listed, it is possible that the percentage of alcohol in the formula is high enough to preserve the product. The mascara is tinted using a mixture of iron oxides.

FORMULATION TEMPLATE FOR MASCARA

Let us have a look at a formulation for mascara. We will start with the formulation template.

Ingredient type	Function	w/w%
Purified water (deionized), or hydrosol, aloe vera juice etc	Solvent	30-60
Water thickeners (eg gums)	Increases viscosity	0.5-3
Film-formers (eg acacia gum)	Provides longevity	1-15
Emulsifier (eg glyceryl stearate SE, xyliance, Montanov 68)	Combines oil and water phases	3-10
Emollients (optional)	Solvent	0-20
Lipid thickeners (eg waxes)	Increases viscosity	1-20
Pigment mixture	Provides tint/color	5-15
Insoluble powders, fibers	Lengthens the lashes	up to 3
Fragrance/essential oils (optional)	Masking agent for raw materials	up to 0.5
Antioxidant (eg Vitamin E)	Prevents oxidation	0.05-0.1
Preservative (broad-spectrum blend, eg Geogard 221)	Prevents spoilage via microbial growth	q.s.*
Preservative booster	Prevents spoilage via microbial growth	q.s.*
Chelating agent	Binds metal ions to boost preservatives	q.s.*

*The abbreviation q.s. stands for 'quantum satis' or 'quantum sufficit', meaning an amount which is enough, or an amount which suffices. This is a term used in template formulas because the amount of preservative depends on the preservative itself and the formula.

Above: Mascara packaging

Above: Acacia senegal gum

Above: Jojoba oil

FORMULATION EXAMPLE FOR BEGINNERS' MASCARA

PRODUCT DEVELOPMENT QUESTIONS

Product type:
Mascara.

Are you formulating to meet a particular standard or certification?
We are using natural ingredients, accepted by COSMOS.

Who is your target audience?
People of all ages, looking for a natural mascara.

What is the purpose/function of your product?
To emphasize eyelashes, to make them bolder and longer.

What properties and qualities do you want your product to have?
High viscosity, highly pigmented emulsion.

What packaging will your product go in?
Mascara tube with a nylon or silicone brush applicator closure.

Which solvents are you using and why?
Purified water (deionized or distilled) as it is easily accessible and easy to use.

Which water thickeners are you using and why?
We are not using any water-phase thickeners. We are adding acacia gum as a film-former to provide longevity after application.

Which emollients are you using and why?
We are using jojoba oil as it is not prone to oxidation and it is not a very heavy or greasy oil.

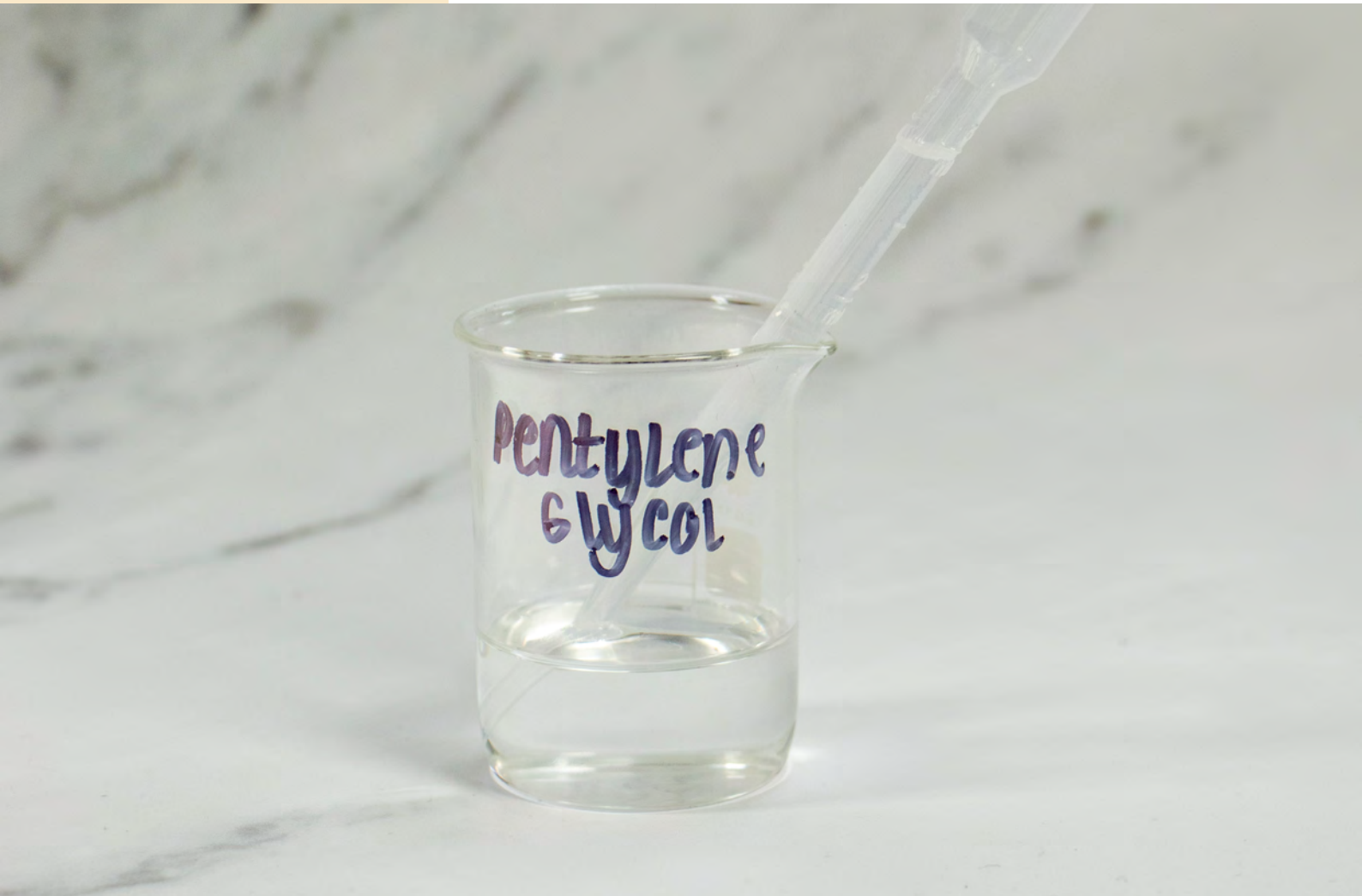
Above: Xyliance

Which lipid thickeners are you using and why?
Candelilla wax, as it is vegan and easily accessible.

Which emulsifiers are you using and why?
Xyliance, as it is a reliable natural emulsifier that also increases the viscosity of the product.

Which pigments are you using and why?
We are using various dark matte pigments – black iron oxide and brown iron oxides.

Which other ingredients specific to this product type are you using and why?
We are using Geogard 221 as the preservative since it is active and has a wider pH range than most natural preservatives. We are also adding pentylene glycol, a naturally derived glycol, as a humectant and preservative booster.



FORMULA

Phase	INCI name	Trade name	Function	w/w%
A	Simmondsia Chinensis Oil	Jojoba oil	Solvent, emollient	17.0
A	Cetearyl Wheat Straw Glycosides (and) Cetearyl Alcohol	Xyliance	Emulsifier	7.8
A	Euphorbia Cerifera Wax	Candelilla wax	Lipid thickener	3.0
A	Various	Pigment mixture of your choice	Colorant	15.0
B	Aqua	Purified water (deionized)	Solvent	46.5
B	Acacia Senegal Gum	Acacia gum	Film-former	7.8
B	Pentylene Glycol	Pentylene glycol	Humectant, preservative booster	2.0
C	Benzyl Alcohol, Dehydroacetic Acid	Geogard 221	Preservative	0.8
C	Tocopherol	Vitamin E (95% mixed tocopherol)	Antioxidant	0.1

INSTRUCTIONS

1. Prepare your pigment mixture.
2. Weigh all phase A ingredients into a beaker. Mix well with a spatula.
3. Heat phase A to 75°C using a water bath or hot plate.
4. Weigh phase B ingredients and combine them in a beaker. Stir with a spatula or homogenize with a stick blender to ensure all the ingredients are fully combined.
5. Weigh the phase B beaker. Record this weight to be used for water loss calculations later. Alternatively, you can cover the beaker with plastic wrap or a silicone cover to prevent evaporation.
6. Heat phase B to 75°C using a water bath or hot plate.
7. Once both phases are at the required temperature, remove Phase B from the heat and weigh this beaker. Calculate the difference between this weight and the initial weight. This value represents water lost through evaporation. Add this amount of purified water lost back into the beaker.
8. Blend phase B with a stick blender until smooth.
9. Add phase B to phase A and mix with a stick blender until the phases are uniform and an emulsion has formed.
10. Leave the batch to cool to 50°C, stirring occasionally to help the batch cool consistently. Alternatively, you can leave this to cool on an overhead stirrer set to low (60rpm).
11. Once the batch has cooled, add phase C ingredients to the main beaker, one by one, stirring well with a spatula between each addition.
12. Check the pH and adjust if necessary.
13. Fill your product into the selected packaging. To transfer the mascara to a tube with a narrow opening, it might be best to first transfer the mascara into a disposable syringe, and then into the tube from there.

PRODUCT SPECIFICATIONS

Appearance: Opaque, thick emulsion.

Viscosity: Thick, high viscosity emulsion.

Color: Various, dark colors.

Odor: Not noticeable.

pH: 4.5-5.0. The pH of our product was 5.1 which we adjusted to 4.6 using 0.1% of a 30% citric acid solution.

FORMULATION EXAMPLE FOR ADVANCED MASCARA

This formula contains a higher percentage of waxes, and thus thickens very quickly, but it also creates a product with longer wear time. Because of its high viscosity, it can be very tricky to work with, so we suggest you get comfortable making the beginners' formula first, before moving on to this one.

PRODUCT DEVELOPMENT QUESTIONS

Product type:
Mascara.

Are you formulating to meet a particular standard or certification?
We are using natural ingredients, accepted by COSMOS.

Who is your target audience?
People of all ages, looking for a natural mascara.

What is the purpose/function of your product?
To emphasize eyelashes, to make them bolder and longer.

What properties and qualities do you want your product to have?
High viscosity, highly pigmented emulsion.

What packaging will your product go in?
Mascara tube with a nylon brush applicator closure.

Which solvents are you using and why?
Purified water (deionized or distilled) as it is easily accessible and easy to use.

Which water thickeners are you using and why?
Xanthan gum to stabilize the emulsion. We are also adding acacia gum as a film-former to provide longevity after application.

Which emollients are you using and why?
We are not including any liquid emollients, in order to create a longer-lasting, thicker mascara.

Which lipid thickeners are you using and why?
We are using candelilla wax, carnauba wax and beeswax, to achieve long wear-time.

Which emulsifiers are you using and why?
Xyliance, as it is a reliable natural emulsifier that also increases the viscosity of the product.

Which pigments are you using and why?
We are using various dark matte pigments – black iron oxide and brown iron oxides.

Which other ingredients specific to this product type are you using and why?
We are using Geogard 221 as the preservative since it is active and has a wider pH range than most natural preservatives. We also added pentylene glycol, a naturally derived glycol, as a humectant and preservative booster.

Right: Xanthan gum

FORMULA

Phase	INCI name	Trade name	Function	w/w%
A	Copernicia Cerifera Cera (Carnauba Wax)	Carnauba wax	Lipid thickener	11.5
A	Cera Alba	Beeswax	Lipid thickener	5.8
A	Cetearyl Wheat Straw Glycosides (and) Cetearyl Alcohol	Xyliance	Emulsifier	5.8
A	Euphorbia Cerifera Wax	Candelilla wax	Lipid thickener	2.3
B	Aqua	Purified water (deionized)	Solvent	56.8
B	Various	Pigment mixture of your choice	Colorant	9.5
B	Pentylene Glycol	Pentylene glycol	Humectant, preservative booster	2.0
B	Xanthan Gum	Xanthan gum	Water thickener	0.2
B	Acacia Senegal Gum	Acacia gum	Film-former	5.3
C	Benzyl Alcohol, Dehydroacetic Acid	Geogard 221	Preservative	0.8

INSTRUCTIONS

1. Prepare your pigment mixture.
2. Weigh all phase A ingredients into a beaker. Mix well with a spatula.
3. Heat phase A to 75°C using a water bath or hot plate.
4. Weigh phase B ingredients and combine them in a beaker. Stir with a spatula or homogenize with a stick blender to ensure all the ingredients are fully combined.
5. Weigh the phase B beaker. Record this weight to be used for water loss calculations later. Alternatively, you can cover the beaker with plastic wrap or a silicone cover to prevent evaporation.
6. Heat phase B to 75°C using a water bath or hot plate.
7. Once both phases are at the required temperature, remove phase B from the heat and weigh this beaker. Calculate the difference between this weight and the initial weight. This value represents water lost through evaporation. Add this amount of water lost back into the beaker.
8. Blend phase B with a stick blender until smooth.
9. Add phase B to phase A and mix with a stick blender until the phases are uniform and an emulsion is formed.
10. Leave the batch to cool to 60°C, stirring occasionally to help the batch cool consistently. Alternatively, you can leave this to cool on an overhead stirrer set to low (60rpm).
11. Once the batch has cooled, add the phase C ingredient to the main beaker, stirring well with a spatula.
12. Check the pH and adjust if necessary.
13. Fill your product into the selected packaging. To transfer the mascara to a tube with a narrow opening, it might be best to first transfer the mascara into a disposable syringe, and then into the tube from there.

PRODUCT SPECIFICATIONS

Appearance: Opaque, thick emulsion.

Viscosity: Thick, high viscosity emulsion.

Color: Various, dark colors.

Odor: Not noticeable.

pH: 4.5-5.0. Our pH was 4.7 so no adjustment was needed.

ADJUSTING THE FORMULA

The main adjustments can be made by varying the types and amounts of lipid thickeners. A thicker mascara with a higher wax percentage will be much trickier to make, but can be easier to use as it will flake less throughout the day and will remain on the lashes for a longer period of time.

PIGMENT MIXTURES

You can use your own pigment mixture by combining any pigments you like. Below are a few recipes for mascara pigment mixtures.

Black

Ingredient	w/w%
Black iron oxide	100

Dark brown

Ingredient	w/w%
Yellow iron oxide	35
Red iron oxide	20
Black iron oxide	45

Denim blue

Ingredient	w/w%
Blue ultramarine	93
Black iron oxide	7

PET RESULTS

As mascaras contain water, a preservative efficacy test (PET), also known as a challenge test, is required to ensure the product is microbiologically safe. Our mascara formulation passed the PET with a criteria A pass, which is the highest pass it can achieve and demonstrates that the mascara is safe for consumer use.

For more information on microbiological testing, including how to interpret PET results, please see our Diploma in Natural Skincare Formulation or refer to our short classes on preservatives, for example Experiment and Report: Testing Four Natural Preservatives or Pentylene Glycol: Natural Multifunctional Ingredient for Cosmetic Preservation.

HAMILTON

ENCLOSURE No. 1 TO REPORT OF ANALYSIS NO. L27170/22/JSHS

RESULTS

Microorganisms	Log reduction					
	T 7	criteria	T 14	criteria	T28	criteria
Escherichia coli	**4,92**	≥ 3	**4,92**	≥ 3 and NI	**4,92**	≥ 3 and NI
Staphylococcus aureus	**4,86**	≥ 3	**4,86**	≥ 3 and NI	**4,86**	≥ 3 and NI
Pseudomonas aeruginosa	**4,93**	≥ 3	**4,93**	≥ 3 and NI	**4,93**	≥ 3 and NI
Candida albicans	**3,87**	≥ 1	**3,87**	≥ 1 and NI	**3,87**	≥ 1 and NI
Aspergillus brasiliensis	**3,81**	-	**3,81**	≥ 0	**3,81**	≥ 1 and NI

$Rx = lg\ N_0 - lgNx$

N_o- number of micro-organisms inoculated at time t_0

Nx- number of surviving micro-organisms at each sampling time t_x

NI- no increase in the count from the previous contact time T7,T14,T28 days

Conclusion: The test confirmed the efficacy of the antimicrobial protection of a cosmetic product. The product meets criteria A.

SUMMARY

In this lesson we explained how to formulate mascara. We shared examples of natural mascaras on the market. We also gave a formulation template and two example formulas for mascara – one for beginners and a second, more advanced formula.