APISARA

COSMETIC EMULSIONS

Understanding and successfully making creams and lotions

> Purpose of this guide Understand how an emulsion works, choose a coherent emulsifying system, organise phases and processing, and diagnose the main causes of instability without reducing formulation to a simple recipe.

Collection: Natural Artisanal Cosmetics - reference guide no. 3

Audience: artisans, beginner formulators, small production units, trainers and self-learners.

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Before you begin

A cream or lotion is a dispersed system: two normally immiscible phases, most often an aqueous phase and an oil phase, are kept together by an emulsifying system and an appropriate physical structure. An attractive texture immediately after manufacture does not prove that the emulsion will remain stable.

> Warning This guide is an educational resource. It does not replace laboratory analysis, a Safety Data Sheet (SDS), supplier specifications, a cosmetic safety assessment, or the regulatory obligations applicable to the product and country concerned.

The recommendations of the emulsifying-system supplier remain essential: use level, process, temperature, pH, compatibility and any need for co-emulsifiers or thickeners.

1. What is an emulsion?

An emulsion is a dispersion of fine droplets of one liquid in another liquid with which it does not spontaneously mix. In cosmetics, the two major types are oil-in-water (O/W) and water-in-oil (W/O) emulsions.

Type	Continuous phase	Common characteristics	Typical uses
O/W	Water	Often lighter feel, easy rinsing, very common	Face/body lotions and creams
W/O	Oil	Richer, more occlusive; in some systems better water resistance	Rich creams, protective products

> Key point Emulsion type is not determined solely by the amount of water or oil. It depends mainly on the emulsifying system, the process and the final organisation of the structure.

2. The four building blocks of an emulsion

Building block	Role	Examples
Aqueous phase	Contains water and water-soluble ingredients	Water, hydrosols, glycerin, some actives
Oil phase	Lipids and oil-soluble ingredients	Oils, butters, esters, some actives
Emulsifying system	Creates and stabilises the oil-water interface	Primary emulsifier + possible co-emulsifiers
Structure / protection	Viscosity, stability, preservation, sensory profile	Fatty alcohols, gums, polymers, preservative, antioxidant

A successful formula results from balancing these elements. Simply increasing the amount of emulsifier does not necessarily correct an unstable formula and may worsen skin feel or tolerance.

3. How does an emulsifier work?

Surfactant molecules used as emulsifiers have an affinity for water and an affinity for oil. They organise at the interface between the two phases, reduce interfacial tension and facilitate the formation of small droplets. Long-term stability, however, also depends on droplet size, viscosity, interfacial structure and interactions among ingredients.

- Primary emulsifier: provides most of the emulsion formation and stabilisation.
- Co-emulsifier: can reinforce the interfacial film or structure and modify texture.
- Consistency agent: increases the structure of the continuous or oil phase; it is not necessarily an emulsifier.

• Gelling agent: can slow droplet movement by structuring the aqueous phase.

4. HLB: useful, but not a magic formula

The HLB (Hydrophilic-Lipophilic Balance) system is a historical tool used, among other purposes, to reason about certain non-ionic surfactant systems and the 'required HLB' of an oil phase. It can be useful where HLB data are relevant, but it is not sufficient to predict the stability of a modern emulsion.

Caution Do not calculate an HLB and then consider the emulsion validated. Many commercial emulsifiers are structured blends designed to be used according to supplier recommendations, sometimes without any practical HLB calculation.

Real-world factors also include the nature of the oils, oil-phase percentage, pH, electrolytes, polymers, temperature, mixing energy and cooling profile.

5. Building the oil phase

The oil phase should not be designed only around the marketing properties of oils. Its composition strongly influences texture, spreadability, perceived absorption, oxidative stability and the requirements placed on the emulsifying system.

Component	Possible effect	Points to consider
Liquid oils	Slip, emollience, skin feel	Oxidation, polarity, viscosity
Butters	Richness, consistency	Crystallisation, graininess, temperature
Waxes / fatty alcohols	Structure, body, physical stability	Waxy feel, dosage, melting
Esters / emollients	Drier or specific sensory profile	Compatibility, availability
Oil-soluble actives	Cosmetic function	Solubility, temperature, dosage

6. Building the aqueous phase

The aqueous phase can contain much more than water, but every addition changes the system. Humectants, salts, extracts, acids, bases, proteins and polymers can affect viscosity, pH, preservation or emulsification.

• Use water of suitable quality.

• Check the actual solubility of water-soluble ingredients.

• Take electrolytes into account: some gelling agents or emulsifying systems are sensitive to them.

• Avoid accumulating aqueous extracts without a clear function: they complicate the formula and may increase preservation constraints.

• Plan the target final pH and preservative system from the formulation stage.

7. Emulsifier, co-emulsifier and thickener: three distinct functions

Function	Main purpose	Common mistake
Emulsification	Form/stabilise the oil-water interface	Assuming every thickener emulsifies
Co-emulsification	Reinforce the system or modify its structure	Treating it as universally applicable
Thickening / gelling	Increase viscosity or structure a phase	Confusing high viscosity with true stability

> Important A very thick emulsion can be unstable, while a fluid emulsion can be perfectly stable. Viscosity is only one component of stability.

8. The manufacturing process

The process depends on the system selected. For many hot-process emulsions, the aqueous and oil phases are prepared separately, brought to a suitable temperature, combined under agitation and then cooled in a controlled manner. Other emulsifiers allow different processes, including cold processing.

Step	Purpose	Monitor
1. Weighing	Follow the formula	Accuracy, material identification
2. Phase preparation	Dissolve/melt correctly	Addition order, hydration, temperature
3. Heating	Reach the required physical state	Avoid overheating and water loss
4. Emulsification	Form droplets and interface	Addition order, shear, duration
5. Cooling	Build final structure	Appropriate agitation, cooling rate
6. Sensitive additions	Protect actives, fragrance, preservative as required	Temperature, solubility, pH
7. Final adjustment	Meet specifications	pH, mass, appearance, homogeneity
8. Filling	Protect the product	Filling temperature, cleanliness, compatibility

9. Temperature: why it matters

Temperature influences melting, phase viscosity, solubility, structure formation and sometimes ingredient effectiveness. 'Heat both phases to 70 °C' is not a universal rule: temperature must be adapted to the system used.

- Avoid unnecessarily prolonged heating, which increases water loss and can degrade ingredients.
- If water evaporates, the final composition is no longer exactly the calculated one; a controlled procedure should limit or documentably correct this loss.
- Respect maximum temperatures for heat-sensitive actives, preservatives and fragrances.
- Observe cooling: some crystalline networks or lamellar structures develop during this phase.

10. Mixing and homogenisation

Mechanical energy helps divide one phase into droplets and distribute them. Too little energy can produce large droplets and a fragile emulsion; too much energy, for too long or at the wrong stage, can also cause problems such as air incorporation, heating, disruption of certain structures or undesirable texture.

Tool	Possible use	Limitations
Spatula / hand whisk	Small trials, some processing stages	Low energy, limited reproducibility
Propeller stirrer	Mixing and cooling	Limited shear depending on geometry
Rotor-stator homogeniser	Efficient droplet-size reduction	Cost, heating, air, possible over-processing

> Reproducibility When comparing two trials, record not only the formula but also the equipment, speed or setting, duration, temperature and order of operations.

11. Cooling: a formulation stage

The emulsion continues to evolve after the phases are combined. Final viscosity may develop gradually; fatty alcohols, waxes, butters and some emulsifiers organise during cooling. Making final judgements while a cream is still hot often leads to inappropriate corrections.

- Do not immediately add more thickener because the hot emulsion looks fluid.
- Maintain enough agitation for homogeneity without unnecessarily introducing air.
- Respect the addition temperatures of cool-down ingredients.
- Assess texture after a consistent maturation period, for example at D+1 and during subsequent stability monitoring.

12. Educational architecture of an O/W cream

The following example is intended to explain how a formula is built. It is not a universal recipe: the emulsifying system and preservative must be selected using their supplier data.

Block	Educational range	Function
Aqueous phase	≈ 65-80%	Aqueous vehicle, humectants, water-soluble actives
Oil phase	≈ 10-25%	Emollience, sensory profile, oil-soluble actives
Emulsifying / structuring system	According to system	Emulsification and structure
Preservative	According to system and regulation	Antimicrobial protection
Actives / fragrance / adjusters	According to specifications	Targeted functions
Water / main component	q.s. to 100%	Bring the formula exactly to 100%

> Apisara method Start with a simple formula. First validate the base system, then introduce actives or extracts progressively. Changing several variables at once makes troubleshooting much more difficult.

13. From lotion to rich cream: what changes?

Objective	Possible levers	Caution
Fluid lotion	Moderate oil phase, low structure, suitable system	Fluid does not mean unstable
Light cream	Balanced emollients/structure, refined skin feel	Avoid overloading with waxes
Rich cream	Higher oil phase and/or stronger structural network	Greasy feel, occlusivity, hot-temperature stability
Cream-balm	Very rich structure, sometimes low water	Preservation still matters whenever water is present

Perceived richness is not determined only by the percentage of oil. The nature of emollients, waxes, fatty alcohols, emulsifier and continuous-phase structure all play major roles.

14. Why does an emulsion become unstable?

Phenomenon	Description	What may be observed
Creaming / sedimentation	Droplet migration caused by density differences	More concentrated layer at top or bottom
Flocculation	Droplets cluster without fully merging	Heterogeneity, texture evolution
Coalescence	Droplets merge	Larger droplets, progressive separation
Breaking / phase separation	Macroscopic separation of phases	Clearly separated oil or water
Ostwald ripening	Some droplets grow at the expense of others	Progressive change in droplet distribution
Crystallisation / grains	Organisation of solid lipids	Grainy texture

15. Troubleshooting: problem → causes → checks → corrections

Problem	Possible causes	Check / correct
Rapid separation	Wrong system, weighing error, unsuitable process	Supplier data, calculation, temperature, order and homogenisation
Separation after a few days	Insufficient structure, incompatibility, droplets too large	Oil phase, viscosity, electrolytes, process
Cream too fluid	Structure still immature, too little structurant, incompatibility	Allow maturation; review formula and process
Cream too thick	Too much structurant, overly strong network	Reduce structurants rationally; do not dilute at random
Grainy texture	Crystallisation of butters/waxes	Thermal cycle, cooling, composition
Stringy / sticky texture	Polymer, humectants, emulsifier combination	Dosages and interactions
Air bubbles	Over-aerating mixing, mixing geometry	Technique, tool depth, speed
pH drift	Ingredients, reactions, measurement, possible contamination	Confirm measurement, monitor over time, investigate

16. Stability: how to monitor an emulsion

Emulsion control does not stop at D+1. A monitoring protocol can compare several conditions to reveal weaknesses more quickly.

Control	What it may reveal	Limitation
Room-temperature observation	Real evolution	Takes time
Elevated temperature	Some accelerated instabilities	Does not predict everything linearly
Hot/cold cycles	Sensitivity to thermal variation	May be harsher than real use
Centrifugation	Tendency to separate	Does not demonstrate shelf life
pH	Chemical drift or other anomaly	Insufficient on its own
Viscosity / texture	Structural evolution	Instrumental measurement preferable for quantification

Packaging should be included in monitoring: a formula stable in a beaker may behave differently in its final container.

17. Microbiological preservation of emulsions

An emulsion containing an aqueous phase should generally be regarded as microbiologically sensitive. The preservative system must be selected for the actual formula, its pH, packaging and conditions of use.

- Do not confuse an antioxidant with an antimicrobial preservative.
- Check the preservative's pH range, solubility and addition temperature.
- Maintain good hygiene practices: a preservative does not compensate for a high initial microbial load.
- Identify the microbiological tests required, including evaluation of antimicrobial protection efficacy where relevant.
- Do not describe an emulsion as 'naturally self-preserving' without sufficient supporting data.

18. Adapting an emulsion to hot climates

In a hot or tropical climate, a texture that is satisfactory at 20-25 °C may become too fluid, separate or change sensorially at higher temperatures. The formula should therefore be designed and tested under conditions representative of its actual use.

- Assess stability and texture at temperatures relevant to the intended market.
- Choose oils, butters and structurants with their thermal behaviour in mind.
- Do not compensate only by adding large amounts of wax: the texture may become heavy or unstable in another way.
- Protect raw materials and finished products from heat and light as far as practical.
- Choose packaging suited to the viscosity the product will actually have under hot conditions.

19. Small workshops: what is realistic?

A small workshop can adopt a highly rigorous approach without possessing every instrument found in an industrial laboratory. The key is to distinguish what can be controlled on site from what requires external validation.

In the workshop	Externalise / investigate further as needed
Weights, temperatures, times, addition order, pH, appearance, comparative monitoring	Microbiological analyses, challenge testing, specialised instrumental analyses
Prototype comparison and storage conditions	Safety assessment and regulatory obligations where required
Batch documentation and retained reference samples	Formal validation of shelf life or claims

20. Checklist before validating an emulsion

Question	Yes / to check
Are the emulsion type and intended use defined?	
Is the emulsifying system suitable for the oil phase and its level?	
Are supplier recommendations being followed?	
Are electrolytes, actives and polymers compatible?	

Question	Yes / to check
Are the process, temperatures and order of addition documented?	
Is the mixing method reproducible?	
Is final pH defined and measured?	
Is the preservation strategy coherent?	
Is stability monitored under several relevant conditions?	
Is final packaging included in the evaluation?	

21. Terminology

Term	Short definition
Continuous phase	The phase surrounding the dispersed droplets.
Dispersed phase	The phase present as droplets within the continuous phase.
Emulsifier	A substance or system that facilitates formation and stability of an emulsion.
Co-emulsifier	A component that reinforces or modifies the emulsifying system.
Coalescence	Fusion of droplets into larger droplets.
Creaming	Migration of droplets without necessarily breaking the emulsion.
Homogenisation	Application of mechanical energy to disperse and reduce droplet size.
HLB	Hydrophilic-lipophilic balance index useful for some surfactant systems, but not universal.

22. Apisara resources

This guide complements Natural Artisanal Cosmetics - Understanding, Formulating and Making and Cosmetic Preservation - Water, Contamination, Preservatives and Shelf Life. Together, these three guides form the initial foundation of the Apisara Cosmetics collection.

Find free guides, technical sheets and tools at APISARA.ORG.

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