APISARA

COSMETIC PRESERVATION

Water, contamination, preservatives and shelf life

> Purpose of this guide Understand why a cosmetic product can deteriorate, distinguish oxidation from microbiological contamination, choose a coherent preservation strategy, and know what conclusions a small workshop can - and cannot - draw from its own controls.

Collection: Natural Artisanal Cosmetics - reference guide no. 2

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

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Contents

1. What are we protecting a cosmetic from?
2. Why water changes everything
3. Water activity: more informative than water percentage alone
4. Routes of contamination
5. Hygiene: reduce the initial microbial load
6. pH and preservation
7. Choosing a preservative system
8. Antioxidants, chelators and preservatives: do not confuse them
9. Packaging: part of the formula
10. Challenge testing: what are we trying to demonstrate?
11. Stability and shelf life
12. PAO, minimum durability and regulation
13. Troubleshooting preservation problems
14. What should be done with a suspect batch?
15. Approach for small workshops and resource-limited settings
16. Preservation checklist before validating a formula
17. Terminology
18. Apisara resources

Before you begin

Preserving a cosmetic is not simply a matter of “adding a preservative”. Preservation depends on the whole system: raw-material quality, water, water activity, pH, manufacturing hygiene, packaging, process, storage conditions and the actual behaviour of the formula.

> 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.

A formula may look perfectly normal while being microbiologically unacceptable. Conversely, a change in odour or colour may result from chemical oxidation without being microbial contamination. The mechanism should therefore be identified before choosing the response.

1. What are we protecting a cosmetic from?

Deterioration	Mechanism	Possible signs	Control measures
Microbial contamination	Bacteria, yeasts, moulds	Sometimes no visible sign; odour, gas or appearance changes may occur	Hygiene, preservative system, packaging, testing
Oxidation	Reaction with oxygen, accelerated by light/heat/metals	Rancidity, odour, colour change, loss of quality	Oil selection, antioxidants, chelators, packaging, storage
Physical instability	Separation, precipitation, viscosity change	Phase separation, grains, sediment, liquefaction	Formulation, process, temperature, compatibility
Chemical degradation	Hydrolysis, ingredient reactions, pH drift	Colour, odour, loss of activity, texture change	pH, ingredient choice, packaging, storage

> Key point An antimicrobial preservative acts against microbial growth. An antioxidant slows certain oxidation reactions. These functions are not interchangeable.

2. Why water changes everything

Microorganisms need available water to grow. Emulsions, gels, shampoos and aqueous lotions therefore require particular attention. Replacing water with a hydrosol, infusion, aloe juice or aqueous extract does not remove this risk.

- Added water may introduce initial contamination if its quality is unsuitable.
- Raw materials may themselves introduce microorganisms or nutrients that favour their growth.
- The user can contaminate the product after opening through fingers, bathroom water or environmental contact.
- Packaging strongly influences recontamination: a wide-mouth jar does not expose the product in the same way as a pump or airless system.

3. Water activity: more informative than water percentage alone

Water activity (aw) expresses the availability of water for reactions and microorganisms. Two products containing the same total amount of water can have different water activities. Salts, sugars, polyols and other solutes can reduce available water, but the actual effect should be measured or validated.

Concept	What it indicates	Limitation
% water	Total amount of water present	Does not directly show how much water is available to microorganisms

Concept	What it indicates	Limitation
Water activity (aw)	Thermodynamic availability of water	Requires appropriate measurement and correct interpretation
Visual appearance	Apparent state of the product	Cannot exclude contamination

Caution A formula that is “very sugary”, “high in glycerin” or contains little water should not be declared self-preserving on intuition alone. The strategy must be justified for the actual formula.

4. Routes of contamination

Stage	Possible sources	Prevention
Receiving	Raw materials, packaging, water	Reliable suppliers, incoming checks, correct storage
Weighing	Hands, utensils, open containers	Hygiene, clean dry equipment, limited exposure
Manufacturing	Worktop, mixer, transfer, ambient environment	Suitable cleaning/disinfection, organised workflow
Filling	Bottles, closures, filling operation	Clean packaging, controlled process
Use	Fingers, water, product return, bathroom	Container choice, instructions for use
Storage	Heat, light, humidity	Defined and suitable conditions

5. Hygiene: reduce the initial microbial load

A preservative is not intended to compensate for dirty manufacturing. The lower the initial contamination, the better the chance that the preservation strategy will be robust.

- Clean before disinfecting: dirt and residues can reduce the effectiveness of disinfection.
- Use a method compatible with the equipment and surfaces.
- Allow to dry when required by the procedure; residual water can become a contamination source.
- As far as possible, separate dirty materials, cleaned equipment, manufacturing and filling areas.
- Avoid poorly maintained cloths, sponges or utensils that can become microbial reservoirs.
- Document simple procedures: what is cleaned, with what, how, when and by whom.

6. pH and preservation

pH directly influences the effectiveness of many preservatives and the growth of certain microorganisms. A preservative that is effective at one pH may become much less active outside its useful range.

- Know the pH range recommended by the supplier of the preservative system.
- Measure the pH of the finished formula using a suitable method.
- Allow for possible pH drift during storage.
- Do not choose a pH solely to “help the preservative”: it must also remain compatible with skin, hair, ingredients and product use.

7. Choosing a preservative system

The choice cannot be made from the trade name alone or from a “natural” label. The actual product and the available technical data must be considered.

Question	Why it matters
What spectrum?	The system should appropriately cover bacteria, yeasts and moulds.
What pH range?	The activity of some preservatives strongly depends on pH.
Where is it soluble?	The preservative must be available in the phase where protection is needed.
At what temperature is it added?	Some systems tolerate high temperatures poorly.
What incompatibilities?	Surfactants, proteins, polymers, salts or packaging may influence effectiveness.
What dosage?	Follow supplier data and applicable regulatory limits.
What packaging?	Risk after opening depends strongly on exposure during use.

> Important Do not arbitrarily reduce a preservative dose to make a formula “more natural”. The useful concentration should be based on system data, regulation and validation of the product.

8. Antioxidants, chelators and preservatives: do not confuse them

Family	Role	Example of function	Does not replace
Antimicrobial preservative	Limit microbial growth	Protection against bacteria/yeasts/moulds	Hygiene and validation
Antioxidant	Slow oxidation	Protect certain oils against rancidity	Antimicrobial preservative
Chelating / sequestering agent	Bind certain metal ions	Reduce some metal-catalysed reactions; may support the overall strategy	Antimicrobial preservative

A robust strategy may combine several hurdles: low initial contamination, appropriate pH, protective packaging, a suitable preservative system and, where relevant, an antioxidant or chelator. This is a logic of complementary hurdles, not automatic substitution.

9. Packaging: part of the formula

Packaging	Exposure during use	Points to consider
Wide-mouth jar	High: fingers, air, possible water	User hygiene, robust formula; a spatula does not eliminate all risks
Tube	Moderate	Air return, opening, viscosity
Pump	Low to moderate	Pump quality, priming, residues
Airless	Often reduced	Compatibility, actual performance, cost
Spray	Variable	Viscosity, mechanism contamination, inhalation depending on product

More protective packaging can reduce exposure after opening, but it cannot turn a poorly designed formula into a safe one. Container-content compatibility should also be checked: adsorption, migration, swelling, leakage, corrosion or loss of seal can affect the product.

10. Challenge testing: what are we trying to demonstrate?

A challenge test (preservative efficacy test) involves deliberately inoculating the product with defined microorganisms and then monitoring their evolution according to a standardised or recognised method. The aim is to assess whether the preservation system adequately controls that contamination under the test conditions.

> What not to do Never attempt to reproduce a challenge test in a workshop or at home by deliberately culturing microorganisms. This test belongs in a competent laboratory.

A challenge test does not replace every other evaluation: initial microbiological quality, stability, packaging, process and conditions of use remain important.

11. Stability and shelf life

A cosmetic shelf life should not be chosen because “a similar product lasts one year”. It should be supported by a body of information: physical and chemical stability, microbiological quality, antimicrobial protection where required, packaging, and foreseeable storage and use conditions.

Follow-up	What it shows	What it does not prove alone
Room temperature	Actual evolution over time	A long shelf life if observation is short
Elevated temperature	Acceleration of some phenomena	A universal equivalence to X months at room temperature
Hot/cold cycles	Physical robustness	Microbiological safety
Centrifugation	Tendency to separate in some formulas	Complete shelf life
Appearance / odour / pH	Visible or measurable drift	Absence of microorganisms

Accelerated tests are useful for comparison and for detecting certain weaknesses quickly, but interpretation should remain cautious: not all degradation mechanisms accelerate in the same way.

12. PAO, minimum durability and regulation

Shelf-life statements, minimum durability dates and Period After Opening (PAO) requirements depend on the regulations applicable in the target market. They should not be assigned arbitrarily. The same formula intended for several countries may be subject to different requirements.

> Apisara rule Always distinguish general technical knowledge from local regulatory requirements. Check the rules applicable in the country where the product is manufactured and/or marketed.

13. Troubleshooting preservation problems

Observation	Possible causes	Reasonable action
Abnormal odour	Oxidation, contamination, degraded fragrance	Isolate the batch; do not mask the odour; investigate the cause
Gas / swelling	Possible microbial activity, chemical reaction	Do not use/sell; investigate
Visible mould	Contamination	Reject the batch; review hygiene, formula and packaging
Phase separation	Physical instability, temperature, process	Investigate formula/process; do not infer contamination without data
pH drift	Chemical reaction, possible contamination, instability	Confirm measurement and investigate

Observation	Possible causes	Reasonable action
Colour change	Oxidation, light, reaction, raw material	Compare controls, storage and materials
No visible change	Product may be acceptable... or not	Appearance alone never validates microbiological quality

14. What should be done with a suspect batch?

- Quarantine the batch and prevent its use or distribution.
- Keep the information: formula, raw-material lots, process, measurements, packaging, dates and storage conditions.
- Do not “repair” a contaminated batch by adding more preservative, fragrance, alcohol or essential oils.
- Investigate the cause: raw material, water, hygiene, dosage, pH, process, packaging or use.
- Use laboratory analysis when the decision requires information the workshop cannot obtain reliably.

> Essential principle A suspect batch intended for application to people should not be used as an experiment. Root-cause investigation must not expose the user.

15. Approach for small workshops and resource-limited settings

When a complete laboratory is not available locally, the correct strategy is not to pretend to replace tests that cannot be performed. It is to reduce risks upstream and know when external validation is necessary.

- Prefer simple formulas with well-documented raw materials.
- Use water of suitable quality and protect it during storage.
- Choose preservative systems supported by usable technical data.
- Measure pH correctly where relevant.
- Avoid highly variable homemade aqueous ingredients when their microbiological quality cannot be controlled.
- Choose packaging that limits contamination during use.
- Document every batch and retain reference samples where appropriate.
- Outsource critical analyses rather than draw conclusions that cannot be demonstrated in the workshop.

16. Preservation checklist before validating a formula

Question	Yes / to check
Have all sources of water in the formula been identified?	
Are water and raw-material quality controlled?	
Is final pH known and compatible with the preservative system?	
Is the preservative used within its technical and regulatory range?	
Does the addition process respect temperature and solubility requirements?	
Does the packaging reasonably limit contamination during use?	
Are hygiene procedures written and applied?	
Is physical/chemical stability monitored?	

Question	Yes / to check
Have the necessary microbiological tests been identified?	
Is the stated shelf life supported by sufficient data?	

17. Terminology

Term	Short definition
Antimicrobial preservation	Strategy intended to prevent or limit the proliferation of microorganisms in the product.
Challenge test	Laboratory test assessing antimicrobial protection after controlled inoculation.
Water activity (aw)	Measure of the availability of water in a product.
Antioxidant	Substance used to slow certain oxidation reactions.
Chelator	Substance capable of binding certain metal ions.
PAO	Period After Opening during which the product is indicated as usable under the relevant regulatory framework.
Stability	Ability of the product to retain acceptable characteristics under defined conditions.

18. Apisara resources

This guide complements Natural Artisanal Cosmetics - Understanding, Formulating and Making. The Apisara collection will progressively be expanded with guides on emulsions, raw materials, surfactants, stability and formulation in small workshops.

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

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