APISARA

COLD PROCESS SOAPMAKING (CP) COMPLETE GUIDE TO PRODUCTION AND PROCESS CONTROL

From formulation to finished-soap control: method, safety, critical parameters, defects and traceability

PURPOSE OF THIS GUIDE

To understand cold process soapmaking as a controlled process, not simply as a recipe. This guide connects formulation, lye calculation, preparation, emulsion, trace, moulding, thermal phase, unmoulding, cutting, curing and quality control.

Audience: beginners, artisans, professionals, trainers and self-learners.

SAFETY FIRST

> Sodium hydroxide (NaOH) and concentrated alkaline solutions are corrosive. Wear suitable safety goggles, compatible gloves and covering clothing, and work in an organised, ventilated area. Always add lye to water, gradually - never water onto solid lye. Follow the Safety Data Sheet (SDS) for the product used. In case of exposure, immediately follow the SDS instructions and advice from the appropriate medical/poison-control service.

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1. Principle of cold process soapmaking

Cold process soapmaking reacts fats and oils with a sodium hydroxide solution without deliberately cooking the soap paste for an extended period. Saponification mainly produces sodium salts of fatty acids - soap - and glycerol. The reaction is exothermic: it generates its own heat.

The word “cold” is therefore relative. Oils may be gently heated, dissolving NaOH strongly heats the water, and the soap batter may reach a high temperature after moulding.

KEY POINT

Cold process soap is not “finished” when the batter thickens. Trace is an observable physical state, not proof that all of the lye has already reacted.

2. Variables to decide before making soap

Variable	What it affects	What to document
Fats and oils	soap profile, trace, hardness, lather, stability	exact oils/butters and weights
NaOH	saponification and calculated superfat	product purity/concentration + calculated amount
Water	fluidity, apparent rate, unmoulding, heat management	water amount or lye concentration
Superfat	formulation margin and unsaponified lipid fraction	calculation method and percentage
Temperature	fluidity, emulsion, thermal phase	temperatures or working range
Additives/fragrance	colour, scent, rheology, stability	type, dose, time of addition

3. Calculate before weighing

The theoretical NaOH requirement depends on each fat and its saponification value. A formula must be recalculated whenever the composition or weights change. Replacing one oil with the same weight of another is not chemically equivalent.

CRITICAL POINT

Never guess an adjustment to the amount of lye after mixing. If a weighing or calculation error is suspected, identify the exact error before deciding what to do. In professional production, the formula, coefficients used, NaOH purity and actual weights should be traceable.

4. Water, concentration and water-to-lye ratio

The amount of water does not change the stoichiometric quantity of NaOH required by the oils, but it strongly affects process behaviour. A more concentrated lye solution contains proportionally less water; a less concentrated solution contains more.

Situation	Possible tendency	Watch for
More water	batter often remains fluid longer	slower unmoulding, shrinkage and cure management
Less water	batter may thicken sooner; often earlier unmoulding	dissolution, local overheating, false thickening, workability
High-solid-fat formula	may thicken as it cools	do not confuse fat solidification with trace
Sugars/milk/honey	possible extra heating and browning	stronger thermal management

For reproducibility, water is better expressed by a defined method - for example lye concentration - rather than by an arbitrary rule unrelated to the NaOH amount.

5. Prepare the work area

- Read the entire formula and prepare a batch sheet before starting.
- Clear the work surface and prevent access by children, animals or unequipped people.
- Prepare a reliable scale, compatible containers, spatulas, immersion blender if used, mould and protective equipment.
- Clearly identify NaOH, water, oils, fragrance and additives.
- Prepare the mould and all required tools in advance: fast-thickening batter leaves little time to improvise.

6. Prepare the NaOH solution

Weigh water and sodium hydroxide separately. Gradually add NaOH to the water, mixing carefully in a compatible container. Dissolution is strongly exothermic and can produce irritating vapour/aerosol immediately around the vessel.

PRACTICAL PROHIBITIONS

Do not use a container unsuitable for heat or strong alkali. In particular, avoid aluminium, which reacts with strong bases. Do not lean over the vessel. Never store lye solution in an unidentified food or drink container.

Allow the solution to reach the working temperature range chosen for the method. If other liquids are used (milk, infusion, etc.), their behaviour with NaOH must be understood and the method adapted.

7. Prepare the fats and oils

Weigh every oil or butter separately. Fully melt solid fats when necessary, then homogenise. Materials that can fractionate during storage should be thoroughly homogenised before sampling.

The working temperature should keep the fats sufficiently fluid without making the batter unnecessarily hot. There is no single universal temperature: the formula, workshop conditions and desired result all matter.

8. Emulsion and trace: do not confuse them

After controlled addition of the alkaline solution to the fats, the mixture changes from separated phases to an emulsion. An immersion blender speeds this step, but excessive blending can make the batter too thick for some designs.

State	Practical observation	Meaning
Stable emulsion	uniform appearance, no visible separation	phases are dispersed sufficiently to continue
Light trace	fine mark on surface, batter still fluid	noticeable thickening; suitable for many swirls
Medium trace	clear mark, more viscous batter	less working time
Thick trace	very viscous batter, pronounced relief	harder to mould; useful for some effects

WATCH FOR “FALSE TRACE” If solid fats cool and recrystallise before a proper emulsion is obtained, the batter may look thick. Check temperatures, homogeneity and mixture behaviour instead of relying only on thickness.

9. Fragrances, essential oils, colourants and additives

Additions may accelerate, slow, temporarily thin, seize, colour or heat the batter. Compatibility, dosage and regulatory status should be checked before production.

- Pre-weigh additives.

- Respect applicable use limits for the product and target market.
- Test every new fragrance/colourant in a small batch.
- Document supplier, batch, dosage and observed behaviour.
- Do not assume that a “natural” ingredient is automatically safe or stable.

10. Moulding and heat management

After moulding, the batter continues to react and may become very hot. Depending on formula, mould size, insulation and ambient temperature, the soap may enter a gel phase: it becomes more translucent and its temperature rises.

Gel phase is neither mandatory nor a defect. The key issue is thermal control. Overheating can cause swelling, a central crack, separation or other defects.

Factor	May increase heating
Large mould / large mass	less heat dissipation
Insulation	retains heat
High ambient temperature	reduces cooling
Sugars, honey, some liquids/additives	may intensify temperature rise
High starting temperature	increases initial thermal load

In hot climates, routine insulation of every mould may be inappropriate. Observe the formula and environment; adapt the mould, insulation and cooling to the actual risk.

11. Unmoulding and cutting

Unmould when the soap has enough cohesion. Timing depends on the formula, water, mould, temperature and process. Unmoulding too early may deform the soap; waiting unnecessarily can make some very hard formulas difficult to cut.

Fresh batter and very young soap may still be strongly alkaline. Wear gloves until safe handling has been established.

12. Curing: a technological stage

Curing is not simply “waiting for the lye to disappear”. Much of the saponification occurs well before the end of a typical cure. During curing, soap loses water, its internal structure evolves and its use properties gradually stabilise.

DURATION

There is no universal cure time valid for every formula. Several weeks are common in artisanal cold process soapmaking, but the professional criterion is measured product behaviour: weight, hardness, stability, performance and internal specifications - not merely a number of days.

Cure in a clean, ventilated area protected from excessive humidity, direct sunlight, odours and contamination. Space bars so that air can circulate.

13. Control the finished soap

A soap that looks successful is not necessarily compliant. Control should be proportionate to the production context and regulatory requirements.

Control	What it tells you	Limitation
Appearance / odour	visible defects, rancidity, homogeneity	does not alone demonstrate chemical safety
Weight / weight loss	change during curing	depends on bar format and environment

Control	What it tells you	Limitation
pH	information on alkalinity under defined conditions	does not directly measure “free lye”; method matters
Free alkali / acidity by method	more specific chemical control	requires an appropriate analytical method
Documented use test	lather, rinsing, durability, wear	subjective without a standardised protocol

> ABOUT THE “ZAP TEST” Deliberately touching soap to the tongue is not a professional method recommended for evaluating free alkali. Use suitable, documented control methods.

14. Defects: problem → causes → checks → correction

Problem	Possible causes	Check	Correction / prevention
Oily separation	insufficient emulsion; weighing error; disruptive additive	formula, weights, mixing, temperatures	quarantine batch; do not sell without diagnosis; correct method
Batter seizes quickly	fragrance, high solid-fat fraction, temperature, blending	new ingredient? temperature?	pilot batch; blend less; adapt temperature/formula
Central crack	overheating	mould, insulation, sugars, ambient conditions	reduce insulation/heat; monitor
Soap stays soft	high water; highly unsaturated profile; error	calculation, water, formula, conditions	allow evolution then diagnose; adjust next batch
White surface powder	often surface sodium carbonate	appearance/location, process	reduce favourable exposure/conditions; distinguish from true excess alkali
Orange spots / rancid odour	oxidation, fragile/old oils, metals	oil batches, storage, water/equipment	reject degraded materials; improve storage/oxidative control

15. Minimum batch record

Data	Record
Identification	formula name, batch code, date, operator
Raw materials	name, supplier, batch/lot, actual weight
Calculation	theoretical NaOH, superfat, purity/concentration used, water/lye concentration
Temperatures	lye solution, fats, batter if monitored
Process	mixing time, emulsion/trace state, blending
Additions	fragrance, colourants, additives: lots and weights
Moulding	mould, insulation/cooling, thermal observations
Unmoulding/cutting	dates/times and observations
Cure	conditions, dates, weight monitoring if used
Final control	appearance, odour, measurements/tests, release decision

16. Cold process procedure in 12 steps

#	Action	Critical point
1	Validate formula and recalculate NaOH/water	no unrecalculated substitution
2	Prepare batch sheet, PPE, equipment and mould	organise before handling chemicals
3	Weigh all materials	suitable scale; double-check where possible
4	Prepare alkaline solution	NaOH into water; ventilation; heat
5	Prepare and homogenise fats/oils	fully melt solids when required
6	Bring phases into chosen working range	avoid solidification or overheating
7	Mix to stable emulsion	do not overblend
8	Add planned ingredients	known dose, order and behaviour
9	Reach consistency suitable for product	trace ≠ complete saponification
10	Mould and manage heat	monitor gel/overheating
11	Unmould and cut at the right time	protect hands
12	Cure, control, document and release batch	no sale before conformity

17. Ten mistakes to avoid

- Measuring ingredients by volume instead of weighing them.
- Using an online recipe without recalculating the lye.
- Changing an oil without recalculating NaOH.
- Confusing trace with complete saponification.
- Working without goggles or an organised workstation.
- Pouring water onto solid sodium hydroxide.
- Using an incompatible material, especially aluminium.
- Adding an untested fragrance or additive directly to a large batch.
- Automatically insulating every mould regardless of ambient heat.
- Selling a batch because it “looks fine” without suitable traceability and controls.

18. What cold process can do - and what it does not justify claiming

Cold process soapmaking allows solid soaps to be produced with considerable freedom of formulation and presentation. The glycerol formed during the reaction remains in the product unless a later process specifically removes it. However, the process itself does not justify therapeutic, dermatological or environmental claims.

Properties and claims must be compatible with the actual composition, available evidence and the regulations of the country where the product is marketed.

19. Complementary Apisara resources

Use this guide together with the Apisara dossiers on fatty acids, lye and saponification, water, superfatting, trace, curing, hardness and solubility, lather, oxidation, hygiene and safety, and risk analysis from oil reception to soap sale.

APISARA RESOURCES

In addition to the saponification calculator, the dossiers and technical sheets available on apisara.org complement this guide. Educational and technical articles are also published on Substack and Facebook. Apisara resources are free.

20. References and technical guidance

For further study: Kevin M. Dunn, Scientific Soapmaking; Luis Spitz (ed.), Soap Manufacturing Technology; textbooks on fats and oils chemistry and supplier specifications. For NaOH and other substances, use the Safety Data Sheet for the actual product employed. Safety, assessment and market-placement requirements must be checked for the relevant jurisdiction.

LICENCE

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