APISARA

TEMPERATURE AND THERMAL MANAGEMENT IN SOAPMAKING

Understanding heat to better control trace, gel phase, defects and reproducibility

> Purpose of this guide To provide practical reference points without turning a complex variable into a false “ideal temperature”. Temperature must always be considered together with the formula, lye concentration, additives, process, mould and ambient conditions.

Educational and technical guide - Beginner to professional level

Eric Bertrand for Apisara - Version 1.0 - 19 September 2026

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1. Why temperature matters

In soapmaking, temperature is not merely a matter of convenience. It influences reaction rate, fat fluidity, thickening, gel phase, final appearance and sometimes process stability. But temperature never acts alone.

Two recipes processed at the same temperature can behave very differently. A formula rich in saturated fatty acids, a concentrated lye solution, certain fragrances, sugars, or a heavily insulated mould may accelerate or intensify heating. Conversely, a very fluid formula, a small mould or a cool room may limit temperature rise.

> **Essential principle** There is no universal temperature that is correct for every soap. A working range is a reference point, not an absolute rule. Good practice is to observe the whole system and document what works for a given formula.

This guide focuses mainly on cold-process soapmaking (CP). Hot-process soapmaking uses a different thermal strategy because heat is deliberately applied to accelerate the reaction.

2. Where does the heat come from?

- Dissolving the lye: dissolving sodium hydroxide in water is strongly exothermic. The solution can become very hot.
- Saponification: the reaction between triglycerides and sodium hydroxide also releases heat.
- Added heat: melted oils, the vessel, previous heating, a warm room or a preheated mould.
- Retained heat: insulation, a large mass of soap batter, or a thick or enclosed mould.
- Additives: some ingredients, especially sugars and sugary liquids, can encourage a stronger temperature rise.

3. Three temperatures to distinguish

Temperature	What it describes	Why monitor it
Lye solution	Temperature of the sodium hydroxide solution after dissolution and cooling.	Safety, reproducibility and behaviour during mixing.
Fats and oils	Actual temperature of oils, butters and fats before mixing.	Fluidity, complete melting of solid fractions and risk of false trace.
Batter / mould	Temperature after emulsification and during the first hours.	Reaction rate, gel phase, overheating and final appearance.

Measuring only the oils and lye solution before mixing does not fully describe the thermal behaviour of the soap. For production intended to be reproducible, room temperature and the thermal treatment of the mould should also be recorded.

4. Working temperature: guidance, not dogma

In artisan practice, many cold-process recipes are mixed after the lye solution and fats have cooled to a moderate range, often around 30 to 45 °C (86 to 113 °F). This is a common reference range, not a standard. Some formulas work at lower temperatures; others need more heat to keep all fats fully melted.

> **Remember** The oils and lye solution generally do not need to be at exactly the same temperature. What matters is that the formula is physically homogeneous, solid fats remain melted, and the conditions suit the desired process behaviour.

With butters or fats that have relatively high melting points, working too cool can cause crystallisation during mixing. The batter may then thicken as though trace has been reached, when it may actually be a false trace.

Conversely, working very warm often speeds up the process and reduces the time available for swirls or complex pours. A higher temperature therefore does not mean “better saponification”.

5. Temperature and speed of trace

Trace is a stage of emulsification and thickening of the soap batter. Its speed depends on many factors: fatty-acid profile, lye concentration, temperature, blending, fragrances, additives and batch size.

Factor	Possible tendency	Caution
Higher temperature	May speed emulsification and thickening.	Effect varies with the formula.
Intensive blending	Strongly accelerates emulsification.	Do not attribute all acceleration to heat.
Formula rich in saturated fats	Often traces faster.	False trace is possible if fats recrystallise.
Certain fragrances	May accelerate very rapidly.	Always test on a small scale.
Sugars / honey	May increase subsequent heating.	Monitor especially after pouring.

When diagnosing a problem, avoid the simplistic conclusion that “the batter traced quickly because it was too hot”. Temperature may contribute, but it is not necessarily the main cause.

6. Understanding gel phase

After pouring, the soap batter may become warm enough to enter what is called gel phase: it becomes more translucent and can look jelly-like. This is common in cold-process soapmaking and does not, by itself, indicate a defect.

A soap that has fully gelled often develops stronger colours and a somewhat different appearance from an ungelled soap. Gel phase may be encouraged, accepted or avoided depending on the desired appearance and process.

Partial gel When the centre gels but the edges do not, a darker area or ring may appear after unmoulding. This is mainly an appearance difference. For consistent production, it is preferable to aim either for an even gel or for an even limitation of gel.

7. Overheating: recognising the signs

Excessive temperature rise can reduce process control. Possible signs vary with the formula and stage of production.

- batter swelling or rising in the mould;
- a crack or opening forming on the surface;
- a very hot, very fluid or strongly translucent centre;
- surface deformation;
- separation or seepage in severe cases;
- an unusually strong odour associated with substantial heating of certain ingredients.

Practical response If soap in the mould shows clear signs of overheating, remove insulation and place the mould in a cooler, stable environment. Avoid unnecessary handling of hot soap batter that may still contain active alkali. Document the incident before changing the recipe.

Formulas containing honey, sugars, certain milks or other heat-sensitive ingredients require particular attention. Their presence does not automatically make the soap unsafe, but it can substantially change thermal behaviour and appearance.

8. Cool or insulate the mould?

Objective	Possible approach	What to monitor
Encourage an even gel	Retain heat moderately, depending on formula and mould size.	Do not over-insulate an already highly exothermic formula.
Limit gel	Reduce insulation and cool the mould promptly if appropriate for the formula.	The centre of a large mould may remain warm.
Protect heat-sensitive ingredients	Use a more cautious thermal strategy.	Sugars, milks and some colourants can react differently to heat.
Standardise production	Keep the same mould, batch mass, environment and protocol.	The same recipe behaves differently when scale changes.

9. Scaling up

Moving from a small trial to a larger batch is not thermally neutral. A larger volume generally has a lower surface-area-to-volume ratio, so it loses proportionally less heat. A recipe that behaves calmly in a small mould may therefore become considerably warmer when produced at a larger scale.

> **For artisans** and professionals Any significant increase in batch size should be treated as a process change. Validate the new scale step by step and record temperatures and observations before standardising production.

10. Ambient temperature and season

A recipe validated in winter may behave differently in summer. The room, raw materials, moulds and equipment do not start at the same temperature. In hot climates, this effect can be particularly important.

- record the approximate room temperature;
- keep raw materials and moulds out of direct sunlight;
- allow raw materials to reach consistent working conditions;
- adjust mould insulation to the season;
- do not mechanically copy a thermal protocol designed for another climate.

11. Measuring correctly

A digital probe thermometer or an infrared thermometer can be used depending on the situation. A probe measures at the point of contact and can measure within a liquid. An infrared thermometer mainly measures the surface; it is convenient, but the reading can differ from the internal temperature of a mass.

For batch comparisons, use the same instrument, method and measurement points whenever possible. Consistency of measurement is often more useful than apparent precision to a tenth of a degree.

12. A simple thermal-control protocol

To turn experience into a reproducible process, use a batch record. The following protocol provides a practical foundation:

Stage	Record
1. Preparation	Room temperature, batch mass, mould type and any special ingredients.
2. Fats and oils	Temperature immediately before mixing and confirmation that all solid fats are fully melted.
3. Lye solution	Concentration / water amount and temperature immediately before mixing.
4. Emulsification	Time, approximate blending duration, temperature if useful, and appearance of the batter.
5. Additives	Type, quantity, time of addition and observed effect on the batter.
6. Pouring	Time, insulation or cooling applied.
7. Monitoring	Gel, cracking, swelling, temperature or observations during the first hours.
8. Result	Unmoulding, cutting, uniformity, defects and decision for the next batch.

Change only a limited number of parameters at a time. Otherwise, it becomes difficult to determine which modification actually improved or worsened the result.

13. Quick diagnosis

Observation	Points to investigate	Control approach
Immediate thickening	Temperature, recrystallising fats, fragrance, blending, formula.	First check for false trace and accelerants.
Dark ring in the centre	Partial gel.	Make thermal management more uniform.
Crack on top	Significant heating / possible overheating.	Reduce insulation and review exothermic factors.
Soap remains very soft	Not only temperature: water, formula, alkali dosage, time.	Recheck the calculation and batch record before diagnosing.

Observation	Points to investigate	Control approach
Different result by season	Room, materials, mould and heat dissipation.	Standardise and record ambient conditions.

14. What to avoid

- Imposing one temperature on every recipe. A value that works for one formula is not a universal standard.
- Trying to make the oil and lye temperatures exactly equal. Exact equality is generally unnecessary.
- Confusing trace with cooling fats. False trace can hide inadequate emulsification.
- Automatically over-insulating. Insulation should respond to the actual behaviour of the formula.
- Ignoring batch size. Moving to a larger mould changes heat dissipation.
- Changing several variables at once. This makes it difficult to identify the cause of a change.
- Relying only on appearance. Visual observations must be interpreted alongside the batch record and formulation calculation.

15. Checklist before pouring

Check	Yes / review
All fats are completely melted and homogeneous.	☐
The working temperature suits the formula rather than being chosen automatically.	☐
The lye-solution concentration is known and recorded.	☐
Additives likely to accelerate or increase heating have been identified.	☐
The fragrance has been tested or its behaviour is known.	☐
Mould type and size are recorded.	☐
The post-pour strategy has been decided: insulation, ambient conditions or cooling.	☐
Monitoring during the first hours is planned if the formula is new.	☐

> Central idea Controlling temperature does not mean aiming for one perfect number. It means understanding where heat is produced, where it is retained, how it interacts with the formula, and then making the process consistent enough to obtain the same result from batch to batch.

16. Going further

Technical note. The rate of a chemical reaction generally increases with temperature, but soap batter is a complex multiphase system: dissolution, emulsification, crystallisation, heat transfer and chemical reaction evolve simultaneously. This is why a single temperature instruction cannot, by itself, predict the behaviour of the batter.

Formulation remains fundamental: fatty-acid profile, alkali quantity, lye concentration, superfat, additives and process must be coherent. Thermal management then becomes a tool for control and reproducibility.

General references

- Dunn, K. M. Scientific Soapmaking: The Chemistry of the Cold Process. Clavicula Press.
- Spitz, L. (ed.). Soap Manufacturing Technology. AOCS Press.
- Cavitch, S. M. The Soapmaker's Companion. Storey Publishing.
- Safety Data Sheets (SDS) and technical specifications for the raw materials used: these always take priority for safety and handling information.

Apisara resources

In addition to the saponification calculator, you can find guides, technical dossiers and reference sheets at apisara.org. Access to articles published on Substack and Facebook is also available there, helping keep social links up to date.

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