APISARA

HOT PROCESS SOAPMAKING

Complete method and process control

PURPOSE OF THIS GUIDE

To understand what heat actually changes during saponification, conduct a reproducible hot process, recognise useful process stages and avoid common errors. This guide mainly concerns solid soaps made with sodium hydroxide (NaOH).

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

Reading level: the main text provides the practical method; boxes and tables add technical detail.

SAFETY WARNING

> Caustic soda is corrosive. This guide is educational material. It does not replace a Safety Data Sheet (SDS), supplier specifications, laboratory analysis, a cosmetic safety assessment, or the regulatory requirements applicable to the product and country.

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1. Understanding hot process saponification

Saponification is the reaction between triglycerides in oils or butters and a strong alkali. For solid soap, the alkali is generally sodium hydroxide. The reaction mainly produces fatty-acid salts - soap - and glycerol.

In hot process soapmaking, heat is deliberately maintained after emulsification or trace to accelerate the reaction. The paste changes under the combined effects of chemical reaction, temperature, available water and mixing.

KEY POINT

Heat does not create a different kind of saponification: it accelerates and supports the same chemical reaction. Success still depends first on correct lye calculation, a stable emulsion, controlled temperature and an appropriate amount of water.

The method is commonly called Hot Process (HP). Small batches may be made in a slow cooker or other suitably controlled heated vessel; larger-scale production requires appropriate equipment.

2. Differences from cold process soapmaking

Point	Cold process	Hot process
Heat input	Low or indirect after mixing.	Deliberately maintained during part of the process.
Reaction rate	Reaction continues notably in the mould.	A large part of the reaction is conducted before moulding.
Texture at moulding	Usually fluid to thick depending on trace.	Often thick, uneven and less pourable.
Appearance	Fine swirls are relatively easy.	Often more rustic unless the process is specifically controlled.
Fragrance/additives	Often incorporated at trace.	Some additions can be made after cooking at a lower temperature.
Maturation	Several weeks are generally required.	Saponification may be well advanced after cooking, but drying and maturation remain useful.

Common misconception: “cooked” does not automatically mean “ready for immediate sale”. Hot process soap generally benefits from losing part of its water and stabilising before use, packaging or sale.

3. Formulation and calculations before production

The formulation must be completed before production starts. Do not attempt to correct a cooking paste at random by adding lye, oil or water without calculation.

Essential parameters include:

- exact mass of every oil and fat;
- saponification value used for each raw material;
- theoretical NaOH requirement;
- chosen superfat, obtained by lye discount and/or a calculated post-saponification addition, depending on the method;
- water amount or alkali-solution concentration;
- dosages of fragrances, colourants, chelators and other additives.

SAP VALUES

Saponification values are averages. Natural oils vary with origin, batch, refining and composition. In professional production, supplier data and, where necessary, raw-material analyses take precedence over generic values.

For small batches, a moderate lye concentration often makes the process easier to manage. Too little water can make the paste become compact very quickly; excess water lengthens drying. There is therefore no single universal water amount for every formula and every piece of equipment.

4. Equipment, organisation and safety

Function	Recommended equipment / precaution
Weighing	Scale suitable for batch size; dry, identified containers.
Lye solution	NaOH-compatible, stable, heat-resistant vessel.
Cooking	Stainless-steel vessel or suitable equipment with controllable heat.
Mixing	Resistant spatula and suitable stick blender; avoid splashes.
Temperature	Thermometer suitable for the working range.
Protection	Splash goggles, suitable gloves, covering clothing and closed shoes.
Ventilation	Well-ventilated area, especially while preparing the lye solution.

Organisation: prepare and identify all ingredients before starting. Keep children, animals, food and drinks away. Keep a clear safe area where a hot vessel can be placed immediately if work must stop.

ESSENTIAL RULE

Always add solid sodium hydroxide to the water using a safe, controlled procedure - never pour water onto a mass of solid NaOH. Follow the product SDS and avoid inhaling fumes or aerosols generated during preparation.

5. Step-by-step procedure

1 - Prepare the workstation

Check the formula, weighing, PPE, mould, additives and availability of a safe work area.

2 - Weigh the fats

Weigh every oil and butter separately. Gently melt solid fats, then homogenise the oil blend.

3 - Prepare the lye solution

Weigh water and NaOH separately. Gradually add the sodium hydroxide to the water, mix carefully and allow the solution to clear and cool in a secure place.

4 - Combine fats and lye solution

When the selected temperatures are suitable for the formula and equipment, add the lye solution to the fats.

5 - Emulsify

Alternate hand stirring with short bursts of the stick blender. The initial objective is a stable emulsion, not unnecessary over-blending.

6 - Apply heat

Maintain gentle, controlled heat. Cover only when the process and equipment permit it, while watching for any rise in the soap paste.

7 - Observe and mix as needed

The paste thickens and may show several successive appearances. Scrape the sides and homogenise without unnecessary hazardous handling.

8 - Continue to a homogeneous, properly processed paste

Do not decide that cooking is finished solely from appearance. Time depends on formula, water, batch size, temperature and equipment.

9 - Lower the temperature for sensitive additions

Remove or reduce heat. Add planned sensitive ingredients when the paste has cooled enough to limit degradation or volatilisation while remaining workable.

10 - Mould

Transfer the paste promptly, press it down to limit air pockets, then smooth or texture the surface.

11 - Cool, unmould and dry

Allow to cool fully. Unmould and cut when sufficiently firm, then place the bars under conditions favourable to drying and maturation.

6. Recognising process stages

Traditional descriptions such as “applesauce”, “mashed potato” or “petroleum jelly” can help communication, but they are not universal scientific measurements. Not every formula visibly passes through the same appearances.

Possible observation	Cautious interpretation	Action
Creamy emulsion	Phases mixed; reaction underway.	Continue according to the process.
Rapid thickening	Reaction, temperature, composition or relatively low water may accelerate setting.	Reduce heat if needed; mix carefully.
More translucent edges	Transformation and heating are uneven through the mass.	Scrape and homogenise carefully.
Glossy/translucent paste	Common during or near the end of cooking, but not analytical proof that reaction is complete.	Assess the complete process and perform planned controls.
Persistent oily separation	Broken emulsion, weighing/formulation error or temperature problem may be involved.	Do not mould as a normal batch; diagnose first.

7. Superfat, fragrance and additives

> DO NOT USE THE “ZAP TEST” AS A PROFESSIONAL CONTROL Deliberately touching potentially caustic soap paste or soap to the tongue is not a recommended control method. Controlled production relies on calculations, traceability, appropriate measurements and, when necessary, analysis.

Superfat by lye discount: NaOH is calculated below the theoretical amount required to saponify all fats. This is straightforward and reproducible, but it does not guarantee which specific oil remains unsaponified.

Adding fat after cooking: this is often presented as a way to “choose” the superfat oil. Caution is needed: reaction may not be perfectly complete and fatty-acid exchange remains possible. The addition must be calculated and documented.

Fragrances and essential oils: cooking can increase losses of volatile compounds. When the formulation permits, adding them after heat is removed and at a sufficiently lower temperature may reduce losses. Usage limits, allergens and regulatory duties still apply.

Colourants, milks, sugars, clays and botanical powders: these can change viscosity, temperature, colour, odour and paste behaviour. Test them on a small scale before routine production.

8. Moulding, cooling and maturation

Hot process paste still contains water. After moulding, the soap continues to change physically through cooling, moisture redistribution, crystallisation of some phases and gradual water evaporation.

The optimum time before use or packaging depends on formulation, water content, bar size, relative humidity and ventilation. A drying period often improves hardness and service life.

PROFESSIONAL APPROACH

Instead of assigning the same arbitrary curing time to every soap, monitor mass loss on representative samples. When mass becomes sufficiently stable according to an internal criterion, the batch has reached a much more reproducible drying state.

9. Quality controls

Quality control should not be limited to pH. An alkaline pH is normal for traditional soap and, by itself, does not prove the absence of excess alkali.

Control	Purpose
Batch record	Verify materials, lot numbers, weights, operator, dates, temperatures and deviations.
Appearance / homogeneity	Detect separation, pockets, cracks, weeping or heterogeneity.
Mass	Monitor yield and water loss during drying.
pH - defined method	Monitor batch consistency using a reproducible method; do not interpret it alone as a free-lye test.
Free alkali / alkalinity	When required, use an appropriate analytical method to investigate excess alkali.
Moisture / volatile matter	Useful for standardising drying, hardness, storage and yield.
Use tests	Assess lather, hardness, dissolution and performance after batch safety has been validated.

10. Defects, causes and corrections

Problem	Possible causes	Checks / corrections
Paste separates	Insufficient emulsion; weighing error; unsuitable temperature; difficult formula.	Stop increasing heat; review batch sheet; carefully homogenise if formulation is correct. Quarantine if uncertain.
Paste becomes dry/crumbly	Excess evaporation; too little water; excessive or prolonged heat.	Reduce heat; check calculation and water loss. Any water correction must be controlled and documented.
Paste rises/overflows	Excess heat; strongly exothermic reaction; vessel too full; sugars/additives.	Cut/reduce heat and secure area; use adequate vessel headspace next time.
Liquid pockets after moulding	Poor homogenisation, separation or poorly incorporated addition.	Quarantine and identify the liquid before making a decision.
Soap remains soft	High water; high unsaturated-fatty-acid formula; humid environment.	Extend drying, improve ventilation; review water/formula for future batches.
Odour/colour altered	Overheating; heat-sensitive fragrance/additive; oxidation or degraded raw material.	Check addition temperature, storage and raw-material quality.
Caustic batch suspected	Lye, weighing or homogenisation error.	Do not use or sell. Isolate, review calculations and perform appropriate analytical controls.

Troubleshooting principle: problem → plausible causes → objective checks → documented correction. Avoid empirical “repairs” that destroy batch traceability.

11. Professional process control

Reproducibility does not come from memorising a cooking time but from controlling variables. Two batches of the same recipe may behave differently if ambient temperature, vessel fill, water content or raw materials change.

For each regular formula, establish a process sheet containing at least:

- formula reference and version;
- lot numbers and masses of all raw materials;
- lye-solution concentration or water amount;
- key temperatures and heating method;
- start time, observed stages and approximate duration;
- post-cook additions and incorporation temperature;
- paste yield and soap mass after drying;
- control results and batch-release decision.

COMPARING TRIALS

Change only a limited number of parameters at a time. If water, temperature, fragrance and fatty-acid profile all change together, identifying the cause of an improvement or defect becomes difficult.

At professional scale, risk assessment should also cover thermal and chemical burns, manual handling, slips, ventilation, ergonomics, cleaning, cross-contamination, chemical storage and emergency procedures.

12. Practical batch sheet

Stage	Points to check
Before	Formula checked; NaOH/water calculation; identified materials; PPE; equipment and mould ready.
Weighing	Every material weighed and recorded; critical values double-checked.
Lye solution	Prepared safely; vessel identified; temperature monitored if required.
Emulsion	Stable before cooking continues.
Cooking	Controlled heat; paste-rise surveillance; observations recorded.
Additions	Dosages checked; temperature compatible with sensitive ingredients.
Moulding	Homogeneous paste; mould filled/pressed; batch identified.
After	Cooling; cutting; drying; controls; results recorded.
Release	Batch meets internal criteria and applicable regulatory requirements.

Release Batch meets internal criteria and applicable regulatory requirements. 10 key points

- Hot process uses the same fundamental saponification reaction as cold process, with heat applied during the process.
- Accurate lye calculation remains the first safety barrier.
- Heat must be controlled: hotter does not mean better.
- Paste appearance helps follow the process but does not replace controls.
- A dry paste or overflow often indicates poor thermal or water management.
- Superfat must be calculated and its method clearly defined.
- Sensitive ingredients often benefit from addition after temperature is reduced.

- Hot process soap may be extensively saponified at the end of cooking, but still benefits from drying/maturation.
- pH alone does not demonstrate the absence of free alkali.
- For consistent production, document variables, deviations and results for every batch. Apisara resources

In addition to the saponification calculator, Apisara technical guides and fact sheets are intended to build a free knowledge base for hobbyists, artisans, professionals and trainers. Articles published on Substack and Facebook complement these resources.

apisara.org - Apisara website and resources Substack - in-depth articles and technical files Facebook - educational publications and Apisara news

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