APISARA TECHNICAL GUIDE

FORMULATING A SOAP RECIPE

Building, calculating and checking a balanced formula

Purpose of this guide

Move from an idea for a soap to a technically coherent formula. This guide explains how to reason about fats and oils, fatty acids, superfat, water and lye, and how to check the formula before production. It does not offer a “magic recipe”: it provides a reusable method.

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

Useful prerequisites: basic knowledge of saponification, lye and the main fatty acids.

Essential principle

> A recipe that saponifies is not necessarily a good formula. A formulation must also suit its intended use, remain pleasant throughout use, be reproducible, and meet safety, process and regulatory constraints.
>
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Contents

1. Start by defining the soap
2. Think in terms of fatty acids, not oils alone
3. Build the fat-and-oil base
4. Superfat: understand what you are adjusting
5. Water and lye concentration
6. Teaching example: build and check a formula
7. Verification procedure before production
8. Common formulation mistakes
9. Test like a formulator
10. From prototype to reference formula
11. Checklist before approving a formula

1. Start by defining the soap

Before choosing oils, define the product you want. Formulation depends on intended use, process and production constraints.

- Use: hands, body, household cleaning, shaving, etc. A toilet soap is not formulated like a stain-removing soap.
- Process: cold process (CP) or hot process (HP), moulding, working temperature and possible decorative techniques.
- Desired qualities: sufficient hardness, resistance to dissolving in water, lather, skin feel, ease of unmoulding and cutting.
- Constraints: available raw materials, cost, stability, allergens, regulations and production capacity.

Key point

Formulation is a matter of trade-offs. Increasing one property may reduce another. The goal is not to maximise every indicator, but to obtain a coherent whole suited to the intended use.

2. Think in terms of fatty acids, not oils alone

Each fat or oil contributes a fatty-acid profile. This profile explains much of a soap's behaviour. Two differently named oils may have similar profiles; conversely, the same oil can vary with variety, origin and batch.

Fatty acid / family	Typical contribution to soap	Point to watch
Lauric / myristic	Quick lather, cleansing action, hardness	At high levels, the soap may be perceived as strongly cleansing.
Palmitic / stearic	Hardness, structure, durability, creamier lather	High levels may accelerate thickening and change batter handling.
Oleic	Conditioning feel, mildness in use, more restrained lather	Very oleic-rich formulas may benefit from a longer cure before reaching their best performance.
Linoleic / linolenic	Adds flexibility to the profile and sensory interest depending on the oils	More oxidation-prone; monitor freshness, storage and proportion.
Ricinoleic	Helps support and stabilise lather	Castor oil is generally used as one component rather than as the sole base oil.

Indicators calculated from fatty-acid profiles are formulation aids. They do not directly measure the real user experience: process, cure, water, additives, raw-material quality and conditions of use also matter.

3. Build the fat-and-oil base

A simple method is to build the formula by function and then adjust percentages. Start with a structuring fat or oil, add an oleic-rich component, include a lauric/myristic source when appropriate for lather and cleansing, then use smaller amounts of particular oils for specific characteristics.

There is no universal percentage that works for every recipe. Ranges commonly quoted online are empirical guidelines, not standards.

Working method

1) Choose 3 to 5 fats or oils, each with a clear function. 2) Examine the overall fatty-acid profile. 3) Check whether the expected properties suit the intended use. 4) Adjust gradually. 5) Calculate the lye using the SAP values in the calculator or reliable supplier data.

4. Superfat: understand what you are adjusting

In formulation calculations, superfat generally refers to reducing the amount of lye below the theoretical quantity required to saponify the fats and oils. A margin of unsaponified fatty material therefore remains in the soap, subject to real variations in raw materials and process.

A higher superfat does not automatically mean a “better” or milder soap. It can affect lather, skin feel, cleansing, stability and durability. The appropriate level depends on the formula and intended use.

Important

Never try to correct a lye weighing error by assuming that a high superfat will compensate for it. Lye must be calculated with appropriate SAP values and weighed accurately using a suitable scale.

5. Water and lye concentration

Water quantity strongly influences the process: fluidity, thickening rate, heat development, unmoulding and water loss during cure. It is generally more rigorous to work with lye-solution concentration than with a simple water-to-oils ratio.

Lye concentration = mass of NaOH ÷ (mass of NaOH + mass of water) × 100.

Example: 100 g NaOH with 200 g water gives a 33.3% solution. This concentration describes the alkaline solution; it must not be confused with superfat.

Lye safety

Always follow safe sodium hydroxide handling procedures: appropriate protective equipment, suitable ventilation, compatible containers, no children or animals in the work area, and a controlled procedure. Add lye to water according to a safe procedure — never improvise.

6. Teaching example: build and check a formula

The following example illustrates the reasoning. It is not a universal prescription: every formula must be recalculated using the actual SAP values selected.

Fat or oil	Proportion	Intended role
Olive oil	45%	Oleic-rich base; balanced sensory profile and mildness in use.
Coconut oil	20%	Lauric/myristic contribution; lather and cleansing.
Shea butter	20%	Structure; palmitic/stearic contribution and unsaponifiables.
High-oleic sunflower oil	10%	Additional oleic-rich component.
Castor oil	5%	Supports lather through ricinoleic acid.
Total	100%	Base formula to be recalculated before any production.

For a batch containing 1,000 g of fats and oils, the respective masses would be 450 g, 200 g, 200 g, 100 g and 50 g. The exact NaOH quantity is deliberately not given here: it depends on the SAP values used. The calculation must be performed in a reliable calculator using the correct alkali.

After entering the formula into the Apisara calculator, check at least: oils total = 100%, alkali type, SAP value for each material, superfat, water/concentration, total mass and coherence of the estimated properties.

7. Verification procedure before production

- 1. Raw-material identity: make sure each fat or oil matches the material selected in the calculator.
- 2. Percentages: fats and oils total 100%.
- 3. Units: do not mix grams, kilograms, ounces or percentages.
- 4. Alkali: NaOH for conventional solid soap; do not substitute KOH and NaOH without recalculating.
- 5. SAP: use values appropriate to the alkali and, where needed, to the raw-material specification.
- 6. Superfat: check the selected value and its suitability for the intended use.
- 7. Water: verify the lye-solution concentration.
- 8. Additives: record fragrances, colourants, sugars, salts, powders, chelators or other additions separately and consider their effects.
- 9. Double-check: review the formula before weighing, then verify the actual weighed masses.
- 10. Traceability: retain batch number, suppliers, dates, masses, production observations and results after cure.

8. Common formulation mistakes

- Copying a recipe without recalculating it. A change in raw material, SAP value or batch size can make the calculation unsuitable.
- Confusing hardness with durability. A bar that feels hard is not necessarily the one that lasts longest in use.
- Trying to maximise lather. Lather is a user-experience characteristic, not a single measure of quality.
- Using many oils without a clear purpose. A complex formula is not automatically better than a simple, well-controlled one.

- Ignoring oxidation. Oils rich in polyunsaturated fatty acids require particular attention to freshness, storage and stability.
- Treating calculator numbers as absolute measurements. They guide formulation but do not replace trials, observation or appropriate controls.

9. Test like a formulator

A new formula should first be produced as a controlled small batch. Record behaviour at trace, temperature, unmoulding, cutting, changes during cure, odour, colour, lather, feel in use and rate of wear.

When comparing two versions, ideally change only a limited number of parameters at a time. Otherwise it becomes difficult to identify the cause of an improvement or defect.

Professional approach

A formula is truly under control only when it is reproducible. The production record and batch traceability are therefore as important as the recipe itself.

10. From prototype to reference formula

After several trials, establish a reference version: percentages, suppliers or raw-material specifications, selected SAP values, superfat, concentration, additives, process, useful temperatures, mould dimensions, unmoulding/cutting criteria and your minimum internal cure period.

Any significant change should be treated as a new version to evaluate. At professional scale, safety, assessment, product-file, labelling and compliance requirements depend on the country and regulatory category of the product.

11. Checklist before approving a formula

Final check	OK
Intended use clearly defined	☐
Fats and oils = 100%; functions understood	☐
SAP values and alkali verified	☐
Superfat deliberately selected	☐
Lye concentration / water verified	☐
Additives and dosages documented	☐
Calculation reviewed before weighing	☐
Small test batch planned for a new formula	☐
Batch record and observations planned	☐

APISARA RESOURCES

In addition to the saponification calculator, the technical guides and fact sheets available on apisara.org complement this method. Additional educational articles are also published on Substack and Facebook.

These resources are designed to support learning, training and the progressive improvement of soapmaking practice.

Disclaimer

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.

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