

# Design \*Your Own\* Soap Recipe!

Compiled by Kathy Miller <http://millerssoap.com/soapdesign.html>

*All the following information is for those of you who are adventurous and want to develop your own concoctions. If this is just confusing to you, use recipes that have already been developed by others that have the bugs worked out of them. But if you would like to experiment, I'm hoping that this information will give you a starting point! A special thanks to those who have helped provide more useful information...especially to Rachael Levitan.*

-Kathy Miller-

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## How Much Lye to Use?

The first consideration in designing your soap recipe is that the balance of lye to fats be correct so that you will have a mild end product. This is determined by the saponification values of the oils. Elaine White has been very generous in providing this useful information to people via her website. Her chart is widely accepted, but some people think that relying on it alone can yield a harsher soap than using the Lye Calculator at Majestic Mountain Sage (Link Below) which displays the amount needed for a milder product. You can use either...but measure carefully if you're using the original saponification numbers.

In the chart below I have put up the original SAP numbers (Elaine's) and a second set that has a built-in cushion of 5% extra fat. People who make soap all the time sometimes come up with their own favorite numbers, but this will give you something fairly reliable to work from if you don't want to go online every time you create a recipe. If you want to add a bit of superfatting oil at the end, you should still be able to do that with the lighter numbers, but I wouldn't get carried away since some superfatting is already there.

To use the following numbers, take the amount of fat you plan to use in your recipe (in ounces) and multiply it by the decimal number assigned to that type of fat. The resulting answer will be the amount of lye needed (in ounces). You can round your numbers up when you finish calculating them, but I'd wait and round up the whole thing after adding the numbers for each fat you are using in your recipe.) If you are combining fats, you can add the results of the calculations and see how close it comes to the standard 12 ounces of lye that come in a can (I don't like measuring lye crystals or having partial cans left over so the ideal recipe for me will use 12 ounces...if you are buying lye in bulk, this will not be a concern for you). Adjust your fats accordingly. At least 1/4 of your fat content should be a fat that is hard at room temperature but this is not written in stone. When designing your own recipe, a rule of thumb for the water used is approx. 1/3 of the total weight of the fats (in other words, add up the weight of the fats and oils and divide that by 3 for the ounces of water needed). Many people like to have a small cushion of extra fat in a recipe for mildness and usually strive for about 5-8%. If you use the Majestic Mountain Sage Lye Calculator link below, it will make that easier. Here is a list of most of the fats you might think to try in your soap, and a few others you may never want to use! ...

## Saponification Numbers for Lye (Sodium Hydroxide)

*[See Separate PDF file for SAP Chart]*

\* These numbers have been altered from the 5% difference because a slightly higher ratio will work better. Some of them are from Rachael L. who has made quite a study on the subject!

Special thanks to Therese and Bill Lott who provided the spreadsheet that saved me a lot of time in calculations! They will send their spreadsheet lye calculator to you upon request. Please tell them which program you will be using and the version so that they can attach the appropriate file.

Original Saponification Chart courtesy of Elaine C. White who has a soapmaking page on the Web at: <http://members.aol.com/oelaineo/soapmaking.html>

### What is all this talk about "discount" and percentages?

I guess you could figure it this way. It will take a given amount of lye to completely saponify an ounce of a certain fat...with no excess lye or fat left over. This is what the numbers are based on. If you want a cushion of extra fat so that it's milder, you build it in by having 5% more fat in the recipe than you have lye to saponify it...5% excess fat. You can either add on more fat, or subtract some lye...but in the end you want about 5% difference (some people want even more), with the fat being higher. SO, if you figure out how much lye it takes to get it to be a perfect saponification (with no extra of either)...then you take that number and multiply it by .95 (95%), you would then have the amount of lye you want for that 5% cushion. Am I just confusing you more? So, if my recipe said 12 ounces would perfectly saponify the fats, I would multiply 12 oz. X .95 = 11.4 oz. of lye. If I used 11.4 ounces for that recipe, I would end up with it being a 5% discount and would have extra fat in the recipe by that amount. This is more to protect us from errors than anything (measuring types). You can still do a little bit more superfatting with a 5% discount and be okay, but if you get too carried away, your soap could be kind of soft or a bit spongy. The MMS lye calculator is nice because it gives you the measurements in the three areas (although the one that says "proceed with caution" would be fine if you are totally accurate in your measurements).

What complicates this a bit more, is that there is more than one SAP table out there. Elaine White came up with the first one and it is a bit on the higher side for the amount of lye it recommends (and laboratory conditions and the quality of fats can change the numbers a bit too). It doesn't leave much margin for error. The Majestic Mountain Sage people have a slightly altered SAP chart they use for their calculator (don't know exactly how much...but on some of the oils used most often, their numbers are a bit different) and they also show you the quantities you need for certain amounts of excess fat in your recipe. I put up the chart above so that I could use numbers with the 5% built in and figure the recipes without MMS online calculator if I needed to. When I've figured the recipe with milder numbers and the 5% built in, I don't worry about superfatting at the end...unless I put in a tiny amount of castor or vitamin E. or something.

Also something to note: In Susan Miller Cavitch's books she gives a SAP table, but many people fail to notice the the posted numbers are for Potassium hydroxide and not Sodium hydroxide (lye). You have to multiply all of them by a fraction (40/56.1) to get the SAP numbers for lye. I've seen people quote those numbers as the SAP value for lye and wow! Would that ever be a lye heavy recipe if someone used them! I just saw something like this on a site that sells cocoa butter. She had in her specs on cocoa butter a SAP number of 193.8.

Since I use lye in 12 oz. cans, I try to make it come out (on the MMS site) with around "12 oz." shown in the 4-5% range on their chart. If it's not quite right, I back up and change the quantity of oils slightly and refigure until it comes closer.

You can superfat in any number of ways and I don't think it's magical to just add it at the end, assuming it won't get saponified. If the saponification was completed that soon, we could use the soap as soon as it got hard

without aging it (like when you cook it). If your superfatting agents have special qualities you want to retain (like vit. E.) then it might be worth adding them at the end when there's not as much free lye present, but for the other oils, I just add them up front and do the recipe with a 5% discount built in. Superfatting in that case is optional.

### **Majestic Mountain Sage Lye Calculator - Troubleshoot your recipes before disaster strikes!**

As previously stated, many soapmakers prefer to use the Lye Calculator at Majestic Mountain Sage and feel its saponification numbers result in a milder soap. This is a GREAT tool, and before you make a recipe, you plug your ingredients into the open fields, hit a button and it will tell you how much lye is needed for the amount of fats you are using. It is recommended that you make your soap with an extra 5-8% fat to be sure that it will be mild. If you are adding a lot of fragrance oil to a batch ... like 4 oz. or more (essential oils tend to be stronger and have a different composition, so probably not a problem in this regard), you may not want it to be overly superfatted in addition...this may contribute to some soaps oozing glycerin while curing).

A hint for calculating shortening SAPs on MMS: Majestic Mountain Sage doesn't have a field for shortening, since its ingredients can vary. For ease in calculating, you can plug your shortening amounts into the field of some other oil with a similar SAP number. If you like the .126 SAP number for shortening, use the Avocado Oil field.

Majestic Mountain Sage Lye Calculator for Creating Soap Formulas  
<<http://www.thesage.com/calcs/lyecalc2.php>>

### **Yet more saponification numbers!**

These are the SAP numbers from Rachael Levitan, who participates on the Latherings Soap Forum:

"About that oils-vs-fats thing. You need a maximum ratio of at least 40% fats to 60% oils or better... or you'll be stirring all day. So if you're going to make a recipe, just use one or two oils (mix if they have a similar sap value) with 20% coconut, and 20-40% other 'solid at room temperature' fat of your choice... palm, cocoa butter, lard, tallow, etc. Use these numbers and you won't get screwed up... or use the calculator at Majestic Mountain Sage and go for the 6% range for best results. (As a note...this is not always true. I made a castile recipe that had a little over 15% hard fats [coconut and palm] and the rest was olive oil. It traced with the stick blender in about two minutes. Rachael's rule of thumb would depend on which fats were used and their iodine index, etc.)

I swear by these numbers! No adjustments or superfatting deductions or anything. They are really good ones:"

palm .135	shortening .126
tallow .135	olive .130
lard .135	olive pomace oil .126
coconut .178	castor .125
canola .129	beeswax .069
soybean .130	

This is just another option that demonstrates that there's more than one way to do it but whatever you choose, you need to be careful that you don't have too much lye in the soap (or over about 8% extra fat either...you start running the risk of oily or softer bars).

Shortening Composition: Are you confused as to what's really in the shortening you use in soapmaking? It's a little frustrating to use the lye calculator when you don't know the percentages or which oils are present (and until I know that, I figure half-and-half, or will use the recommendation of plugging the shortening amount into the avocado oil field). Here's some more interesting information from Rachael:

I wrote to Crisco, because I wanted to see what was in Crisco 'really'. It makes such hard soap and I wondered why, exactly. Only soybean and cottonseed oils, and mono and diglycerides are listed on my can and some cans say canola, and the rest. But the diglycerides are also other oils and/or their fatty acids ...to help bind the major two oils. Well, it turns out that the binding oil, or mono and diglycerides, is palm. Would you believe that? Here's the paragraph from the letter:

"Crisco consists of: Partially Hydrogenated Vegetable Oils-Base ingredient. Can "flex" (Canola OR Soybean and Palm) according to supply. Switching between Canola and Soybean does not affect performance of shortening. Palm oil is always used to help solidify the product."

## Choosing Your Oils - Oil Properties of Fatty Acids

Fats lend different properties to the soaps they make, depending on which types of fatty acids predominate in their composition. If you know a bit about the oils you are using, you can make a more intelligent choice of which ones will give you the result you desire. Some of the following information and statistics were offered by Toni of Countryside Soap on the Latherings Soap Forum and thanks to her for sending me the original spreadsheet. You'll notice on some of the percentages that there is a fairly wide range, but the chart will still give you a good profile of what to expect from the oil you are choosing. You can also secure this information if you purchase *The Soapmaker's Companion* by Susan Miller Cavitch...a wonderful source of soapmaking information which I highly recommend if you want to get into the chemistry and nitty-gritty stuff about the whole process. If you find this page interesting, you will love her book.

There are other fatty acids present in some of these oils, but these are the basics.

By looking at the predominant fatty acids present in each of the oils you use (particularly the first two numbers and the iodine index numbers), it's possible to select blends that will give you the qualities you value in your finished soap. By looking at the numbers, it's easier to appreciate why olive oil creates such a gentle, moisturizing bar. Soybean will do the same, but will yield a softer soap while olive oil yields a hard one. Palm oil will give you a hard bar, but also has the properties of conditioning to temper its nature, while coconut and palm kernel, with their lower levels of Oleic acid do not provide much in the way of conditioning (especially coconut). The combination of high levels of Lauric and Myristic acids in coconut oil surely account for its great lathering properties!

*[See Separate PDF file for Properties of Oils Chart]*

## How much liquid?

Another question when designing your own recipe is how much water or milk to use (or whatever liquid you are dissolving your lye into). Another general rule of thumb is about a 1:3 ratio of water to fats and a 1:2 ratio if you are using milk. Many soapmakers like to cut back on their water as much as they can to shorten the curing time. If you are doing this, another suggestion by Liz Clouthier (another participant on the Latherings Board) is to calculate how much lye you need for your fats and use enough water to make a 30% solution. For a lot of the recipes on this site that use vegetable oils, I am using 24 ounces of cold water. If you want a bit more, 28 ounces works well. You end up with a firmer bar after 24 hours and it doesn't take as long for the soap to develop its hardness during cure.

**Fragrance:** Essential oils and high quality fragrance oils make the nicest fragrance in soap and you can find them at a health food store or at many mail order companies, some of which are listed below (*Sweet Cakes*, on the Internet, sells wonderful fragrance oils). Whatever you use, be sure it's an oil-based agent with no alcohol in it. Liquid candle scents can be used in soap (more is usually needed) and I have purchased those in the past from the *Pourette Company*. Wax based candle scents such as you typically find at a craft store are useless for

soapmaking. They are hard to incorporate without melting into the fat when it is at its hottest and by the time the soap is finished, the scent is shot! Another possible source for a few essential oils is in the pharmacy. Some oils have pharmaceutical value and can be purchased reasonably...I'm thinking of clove, cinnamon, eucalyptus and peppermint oils in particular. Again, read the label and make sure they have not added alcohol to the oil. Another good source of essential oils and blends at reasonable prices is *A Garden Eastward* (Internet). As a general rule of thumb, you will need from 1.5 to 4 ounces of fragrance or essential oil to scent an 8 pound batch of cold processed soap, depending on the strength of the oils used (2 T. is equal to one ounce of oil). The strongest common essential oils are peppermint, rosemary, cinnamon, clove, spearmint and bitter almond. I probably left some out, but those are the ones you will use less of. Here's a general rule of thumb, although you may not want to use this much...it's personal preference (.5 oz. = 1 T.):

Average Essential Oil	.7 oz. per pound of oils used in soap
Strong Essential Oil (like cinnamon, clove, mint, etc.)	.4 oz. per pound
Citrus Essential Oils	.9 oz. per pound
Average Fragrance Oil	.5 oz. (1 T.) per pound
Strong Fragrance Oil	1 tsp. per pound

If you want to create some of your own blends, here's a great tip from the *Latherings Soap Forum*:

From Toni of *Countryside Soap*: "Here is how I create blends. Take a coffee filter and fold twice in half so you have a nice pointed end. Now take oils that you would like to blend and a dropper. WRITE DOWN everything you do!!!! Try 3 drops for top note 2 drops for middle note and 1 drop for bottom note (this just to get you started). Now place the coffee filter in a jar (I use a jelly jar). Place in your cabinet and check it in a couple of days and see how you like it. You might want to go back and a drop of this or that. I write everything down on a label and place on jar."

To learn more about the properties of the various oils, which combine well together, and which note they are, check out this wonderful resource at *A Garden Eastward*.

### Some Favorite Fragrance Suppliers on the Internet:

*A Garden Eastward* (mainly essential oils): <<http://addy.com/brinkley/index.html>>

*Mint Meadow Country Oils* (wonderful mint oils and blends they grow themselves... also some fragrance oils available): <<http://members.tripod.com/~mintmeadow/index.html>>

*Sweet Cakes* (fragrance oils tested for reliability in cold process soap): <<http://www.sweetcakes.com>>

*Brambleberry* (tested, based in Western Washington): <<http://www.brambleberry.com>>

**Color:** Candle color works very well for soap when mixed into the fats before the lye solution is added (if it's wax based - melted first, separately, in a few tablespoons of the fat and then poured into the rest of the melted fat). You can find these at a hobby store or mail order them from companies such as Pourette. Some people use CRAYONS in the same way, but it takes more since they are rather dilute and you don't always get the end color you are expecting. Some experimentation might be in order. Generally I will suggest you use 1 to 3 regular crayons for the size of the recipes you will find on this site, depending on how strong a color you desire.

Here's some good info from Rachael Levitan (the queen of experimentation) on which crayons do and don't work!:

The only crayons that work are CERULEAN blue, yellow, orange, neon pink (from the neon box), brown, black and white... so you have to mix your own from these.

Prussian blue and red DON'T ...so purple, reds, violet-reds, burgundies, navy, blue, midnight blue, green (yellow and Prussian blue) and anything with red or Prussian blue (just blue in crayola language) don't work, so all the violets are out too. (I have heard from a couple of people that got a nice pink from red crayon...so the jury might be out on this or red crayons may vary by brand...Kathy M.)

Any color made with the Cerulean blue is great, the blue-greens, teals, forest green, jungle green... and I mix them - or the Cerulean blue with a yellow for a great bunch of green variants. Only neon pink works for pink, and added to Cerulean blue, makes lavender.

Liquid food colorings are not very effective when coloring soap and will tend to fade in storage. Liquid chlorophyll is supposed to be nice and also natural cosmetic colorants, such as those you can purchase from the *Pigment Lady*. I have not tried these yet. Certain spices can be used for coloring. Here are some other suggestions...you can use up to 1/2 teaspoon per pound of soap if you like, depending on desired shade. Mix the powder into a bit of the soap and the mix that back in to the rest of the batch. Here are the colors:

Cayenne Pepper	Salmon color
Cinnamon Powder	Beige
Paprika	Peach
Cocoa Powder	Coffee to Brown
Turmeric	Golden Yellow color
Cooking Chocolate Squares	Brown
Curry Powder	Yellow Peach
Liquid Chlorophyll	Light Green

Just remember with color in soap that it will look much darker and warmer when poured than after it sets. Think of how fat changes from gold to white and you can guess how your color can change in appearance and lighten up (and sometimes change shade). If you hit on something you like...WRITE IT DOWN! :-)

Here's some more inspiration on using natural substances for coloring from the *Latherings Soap Forum*.

From Rachael: "I have good luck with yellows, golds, tans, browns, oranges, greens, yellow-greens, pinks, salmons, greys and whites. I have no luck with natural purples, or blues. The powders can be mixed into the raw soap, into the lye water when hot, infused into the oils and strained, or mixed into a portion of the raw soap, and swirled into the rest of the soap, for designs. They vary from leaving pinpoint color dots throughout the whole block of soap, to simply staining the whole block of soap, to dramatic swirls and can look awesome. Start with a teaspoon to a pound of fats, alot of them are mixed to achieve a certain range of color. The reds-pinks-reddish tans-salmons are cinnamon, paprika, some ground rose petals(some go brown), pink clays. The yellows-golds-to tans are milk soaps (nonfat milk instead of water), turmeric, calendula, peanut oil soap, olive oil soap, beta carotene is tiny amounts. The tans-browns slippery elm(which I love because it smells sweet and agreeable), cocoa powder (which will have a dirty lather, but an awesome color, and cocoa butter soap just aches to have cocoa added to it), alot of the ground roses and dried flowers turn brown, cloves. The greens are baby food spinach (strained) gives a clear celery green, chlorophyll from grass clippings, seaweed, sage, green clays. The white is titanium dioxide, its all natural, just doesn't sound like it. Orange is baby food (pureed) carrots, beta carotene in small amounts, milk soap in high temp. range, (with whole fat, not non-fat, cows milk)."

From Sandy: " I ordered some purple soap colour from cranberrylane.com out of Coquitlam, B.C. I got the ground rattanjot which is from an East Indian herb (I think), and a liquid form called "passion for purple" which is probably made by infusing oils with the ground rattanjot. I think I'll try making some of that myself. Anyway, I use 1 T. of liquid and 1/8 tsp. of ground in a 1 lb. batch. It gives a pale purple with purple speckles. Then I add passionflower FO and call it purple passion. Hope this is helpful. "

From Cindy: "I use alkanet root for purple, it will go from rosy purple to blue-purple depending on the ph of your mixture. You soak your main oil in it, I add one cup alkanet root to two cups olive oil, heat gently for a minute, then let sit for a few hours, then strain and incorporate in total weight of olive oil before adding lye. It will look bright red until the lye hits it! "