

## Of Potash and Lye (part 2).

*By Elska Fjarfell from the Dominion of Myrkfaelinn, 2015*

Potash lye is used in soap cooking, glass making and the making of gunpowder in medieval times. Wood ashes, wood ash pastes and lye solutions are also known to be used to clean the house, to clean laundry, to clean ourselves and medicinally to deter bacterial growth on wounds and the skin.

### **What is Potash?**

The part of ash that can dissolve in water and be leached out is called potash, or potassium carbonate. But potash is not the only soluble component, and depending on soil conditions, sodium carbonate, potassium sulfates and sodium sulfates might also be present. Crystallized potash can be used as a fertilizer, to make glass or rehydrated to make lye water for soap cooking.

### **How does Potash become Lye?**

When potassium carbonate ( $K_2CO_3$ ) is in solution with water ( $H_2O$ ) it will react with the hydrogen (H) and hydroxide (OH) of the water, which creates potassium hydroxide (KOH) or potassium lye.

### **What Kind of Wood Ashes?**

To make a useable potassium hydroxide solution hardwood ashes are ideal (“well burnt ashes from good logs” – recipe 1). Soft woods contain more resins and therefore burn hotter than hardwoods. Ashes from woods combusted at temperatures above 900 °C lose a significant amount of potassium to evaporation. Softwoods are known to burn at around 950 °C and hardwoods at around 700 °C, making it likely softwood ash would contain less potassium than hardwood ash.

The best hardwood ashes are light grey to white (sometimes referred to as white ashes), well heated to incinerate or break down most of the organics and combustibles (charcoal) but not over 900 °C. Sieve or sift the white ashes well to remove any partially burnt materials, especially charcoal as it is activated charcoal and when wet will draw minerals out of suspension (purify).

Grass ashes (corn cobs, straw – recipe 3) are known to produce more lye than hardwood ashes, but grass ashes were not generally available in abundance, unlike wood ashes.

### **What Kind of Water?**

Use either rain water or distilled water - well water, spring water and tap water can have many other minerals in solution while still being perfectly fine to drink (like sulfites and chlorides). These minerals can dissolve together with the potassium salts and can later interfere with the soap cooking process.

### **Hot Water or Cold Water?**

Due to the easily dissolving nature of potassium salts it does not really matter to use either cold (recipe 2) or hot water (recipe 1), it will dilute either way. Same with plugging up the vessel and letting it sit (recipe 3), it is in suspension quick enough that as long as the ashes are well tamped down to slow the flow of water to a drip (recipe 1 & 2), most lye leaches out the first time around.

### Add Lime or Quick Lime?

In water, lime (calcium oxide,  $\text{CaO}$ ) becomes slaked lime (calcium hydroxide,  $\text{Ca(OH)}_2$ ), which reacts with potassium salts, such as potassium carbonate ( $\text{K}_2\text{CO}_3$ ) to form calcium carbonate ( $\text{CaCO}_3$ ) and potassium hydroxide ( $\text{KOH}$ ). Depending on conditions the majority of potassium may be leached as the hydroxide anyway, so the lime may only give an incremental increase in lye yield.



### Do Multiple Leachings Increase Strength?

I was not successful using multiple runs to strengthen my lye solution, it comes out at about pH11 either way as checked by Litmus paper. If using a shallow sieve-like whicker basket as a lye vat, making multiple runs does make sense as the water probably leaches through pretty quick - maybe too quick to dilute all the alkaline salts available in the ashes – so in that case more runs would result in a darker, stronger lye solution.

< Hardwood ashes lye making during Colonial times: the leached solution or “black ley” would be dried into Potash or “black salt”, which would be sold when it wasn’t used around the homestead. Black salt would be commercially scorched and purified to remove the carbon to form a white powder called “pearl ash”. This would be used to make white soap and good quality glass.

### Then Why do Multiple Leachings?

The first run of lye solution is very dark in color, in large part by organic compounds (plant lignin, or cellulose) dissolved right alongside the lye and other salts. By running the lye solution through again it became much clearer, and the less colored the lye solution the whiter the soap will be. I theorize some medieval recipes advice to run the lye through again because the solution becomes lighter, or better, for the higher priced white soap making, probably assuming it won’t hurt strength of solution either.

### Is This Solution Pure Lye?

When wood ashes are leached to collect potash all soluble potassium salts are dissolved, which include potassium hydroxide (our lye) and potassium carbonate but also potassium chloride and other impurities like sodium chloride and sodium sulphate. It is important to realize this mixture of different salts when learning to cook soap the medieval way as an excess of these foreign salts could prevent the caustic salts (lye) from acting on neutral fats during soap cooking, thus preventing the saponification process.

Potash can be crystallized by evaporating water from the leached alkaline solution. As potassium carbonate (147g/100ml) is highly soluble compared to sodium sulfate (11g/100ml), potassium sulfate (12g/100ml) and sodium carbonate (22g/100ml) the contaminants will crystallize out of solution first. If the alkaline solution is left alone for a while the less soluble compounds will crystallize out and sink to the bottom while potassium carbonate stays in solution as long as possible. Pour off this solution to leave these crystals behind (clarification – recipe 1) and the lye thus made will have less contamination.

What has also been done to remove impurities during soap cooking is to use multiple applications of lye solution (recipe 1 & 2). As most solubles will be removed the first time around (the first lye), the second and third leachings will be mostly water. During cooking at the point where no more soap curds are formed, either the curds are scooped out of the used up lye solution (the nigre) into another container, or the used up lye solution (the nigre) is poured off, and a second (and third) lye solution is added to saponify the remainder fats. Either way, the settled contaminants are separated from the soap curds.

### **Determine Strength of Solution?**

Medieval soap cooking does not exactly measure the amounts of fats and the strength of the lye solution used. They did find it prudent to use as strong a lye solution as they could make, mostly by evaporating excess water over heat (recipe 1) because otherwise it would need to be evaporated during soap making. But for the soap cooking technique used at that time it was not necessary to know the exact strength of lye as modern soap makers do now, as either the formed soap curds or the remainder liquid nigre is separated during soap cooking. So no need to use floating eggs or similar density or pH tests, all they needed to know was that it is caustic lye, which is tested by tasting on the tongue (recipe 3) as a good lye solution will taste metallic and have a distinct tingle on the tip of your tongue.

### **Does potassium lye make the same soap as sodium lye?**

Potassium is a relatively large molecule compared to sodium (check the periodic table). The larger the molecule the weaker the bond between its parts, thus potassium has a weaker crystalline (solid) structure than sodium, which is a smaller molecule. This means that potassium lye soaps tend to be softer than sodium lye soaps, especially if fats or oils are used which are not solid at room temperature. This is not necessarily a bad thing as potassium soap makes great liquid soap, something sodium soap has trouble with as it does not dilute very well, or stay in solution.

### **Why is table salt added to potassium lye soap?**

Potash soap can be converted by the addition of sodium chloride (common table salt) into soda soap and potassium chloride. The “salting out” of soap was done by first creating a soft potassium soap which was then converted into sodium soap by repeated boiling up with table salt. Adding soda ashes (sodium carbonate) does not work, as carbonates, in contrast to chlorides, have the tendency towards the creation of potash soap and sodium carbonates, whereas chlorides have the tendency towards the creation of sodium soap and potassium chlorides. Soda ashes first need to be leached with water to form sodium hydroxide, which does make sodium soap.

Making medieval soap using leached lye is a truly different process from making soap with commercially available pure lye using modern techniques. Not only is medieval soap a Hot Process soap while most modern handmade soaps are Cold Process, but because of the use of contaminated lye this hot process soap needs to be separated from the cooking liquid, or nigre, which also removes the naturally occurring glycerin! Intrigued? Read more about the process in my documentation “On Lye and Soap (part 3)”.

### *Warning:*

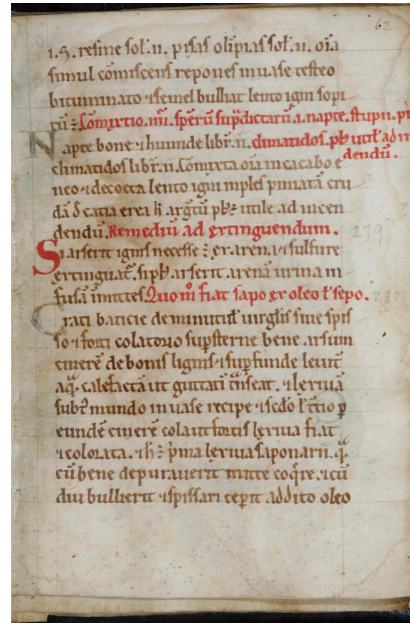
*Do not use aluminum pots to boil lye and/or soap, the alkaline solution will eat a hole and create quite a mess!*

# The Medieval Recipes

## RECIPE 1

*From A 12th century soap recipe from the Mappae Clavicula; A Little Key to the World of Medieval Techniques, p. 70, ca. 1130 AD. [MC]*

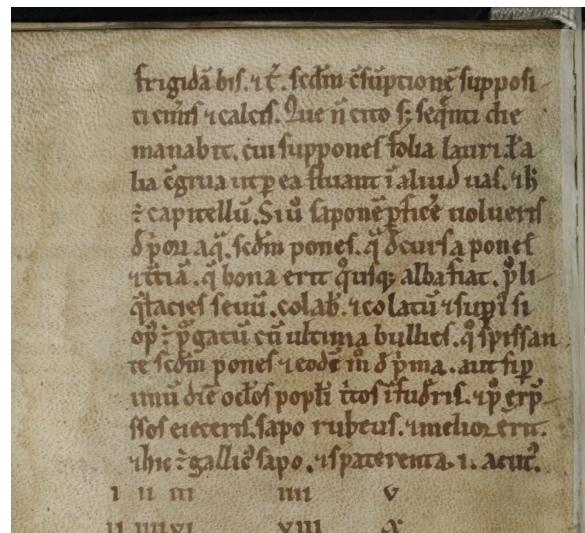
Spread **well burnt ashes from good logs** over woven wickerwork made of withies, or on a thin-meshed strong sieve, **and gently pour hot water on them so that it goes through drop by drop. Collect the lye in a clean pot underneath and strain it two or three times through the same ashes**, so that the lye becomes strong and colored. This is the first lye of the soapmaker. After it has clarified well **let it cook, and when it has boiled for a long time** and has begun to thicken, **add enough oil and stir very well.** [ ]



## RECIPE 2

*A second soap recipe from the Mappa Clavicula, chapter 64, line 21 (Cyril, Stanley & Smith, 1974, p. 115)*

Agitate with cold water two parts of oak ashes with a third of oak [sic] lime. Afterwards when they are well stuck together, put the whole in a basket, **strongly pressed down to make on top a place for the water so that it does not run away. In this you will put cold water two or three times according to the amount consumed by the underlying ashes and the lime. Not quickly but on the following day, the water will drip down onto leaves of laurel or the like placed underneath so that the later it may flow off into another pot**, and this is the capitellum. Now, if you want to make soap, put in a second water following the first, and when that has run down, put in also a third, and **it will be good until it becomes white.** [ ]



### RECIPE 3

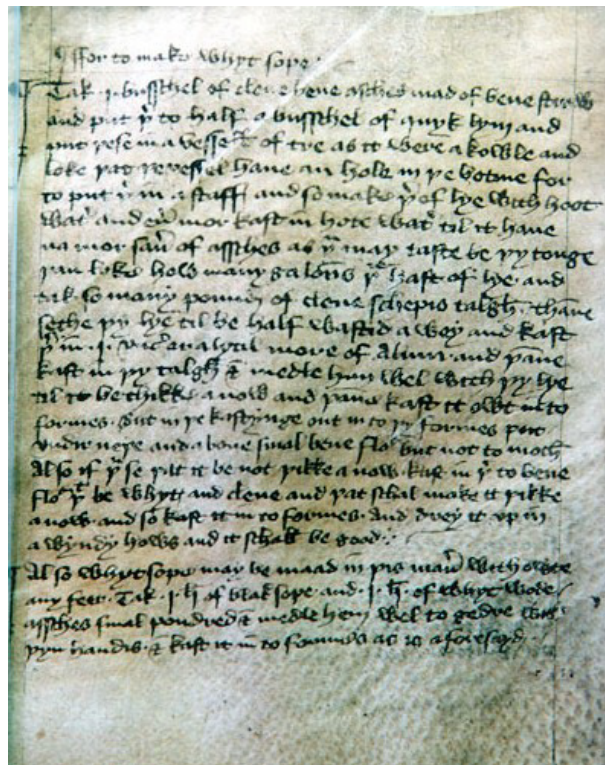
*Soap recipe from the "Tractatus de Magnetate et Operationibus eius", a 13th century letter on the magnet by Petrus Peregrinus; this is a university handbook that includes household and medical recipes, including one for soap. [TM]*

//for to make whyt sope.

//Tak .1. busschel of clene bene asches mad of bene straw and put þer to half a busschel of quyk lym and put þese in a vessell of tre as it were a kowle and loke þat þe vessell have an hole in þe botme for to put þer in a staff and so make þerof lye with hoot water and euer mor kast in hote water til it haue na mor sauer of assches as þu may taste be þy tonge [ ]

//For to make white soap

//Take 1 bushel of **clean good ashes** (made from good straw) and put thereto half a bushel of quick lime, and put these in a wooden vessel, and look that **the vessel has a hole in the bottom** you can plug with a stick, and **so make thereof lye with hot water. And evermore cast in hot water until it (the liquid dripping out) is not sour of ashes, as you may taste by the tongue.** [ ]





# The Making of Potash Lye – a step by step photo essay.

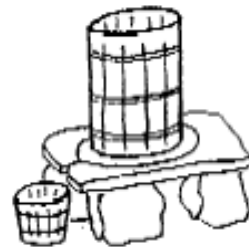
*Redaction by Elska Fjarfell from the Dominion of Myrkfaelinn, 2015*



As medieval options for a lye vat are not all that easily obtainable (tightly woven wicker basket, wood barrel, large metal sieve/funnel or ceramic funnel) I chose to make a glass funnel from a 1 gallon carboy by cutting off the bottom and suspending it in a hemp twine harness hung from a cooking tripod. These are materials and techniques available at that time, and make for a plausible set up.



I triple folded a piece of cheese cloth and tied it with twine tight over the mouth of the bottle, to create a sieve for the lye water to drip out of.



Then I went out to my barrel of hard wood ashes collected over the winter from our woodstove and used a sieve to get a bucket of very fine ashes.

Limit the amount of charcoal as much as you can, it's activated and will leach the lye from the liquid while dripping.



After the mouth of the bottle is covered with cheesecloth, I filled the bottle tightly with ashes, pressing it down hard as I went, to make for a tight fill.



I then suspended the bottle in its twine harness over the wood stand with the ceramic bowl positioned under the mouth of the bottle to collect the lye water (lye water stains wood).



It takes quite a bit of water, and patience, before the water wets all the dry ashes and leeches through to the bottom.

The lye will have a brown amber color, from the broken down organic compounds of the wood.

I use cold water, medieval recipes available mention using either/and cold and hot water – it does not matter much, potassium hydroxide is very soluble and will dilute either way.



Be aware this is a very intriguing project for youngsters!

Once the dilution starts to run clear, and becomes less strong, I run the whole bunch through again to filter out most the brown color.



At the bottom of the right mason jar you see a cloud of crystals in suspension. These are solidified contaminations and can easily be removed (clarified) by pouring off the lye solution while taking care to leave the crystals behind.

The pH of the solution to the left (all in suspension) and the pH of the solution to the right (contaminants settled out) is the same.



You can see from the difference of submersion of the wood spoon I evaporated about half of the lye liquid. One medieval recipe mentions cooking until it gets thick, but since I'm dealing with a small amount I worried I might cook it dry.



From two batches of lye I combined, I ended up with about 23 fluid ounces of useable lye.



Next: Soap!



### Summary of what I learned to do:

- I use a lye vat I made by cutting of the bottom of a one gallon glass carboy, and suspend it from a cooking tripod by way of a knotted twine harness.
  - The bottle's mouth is covered with a folded piece of cheesecloth, tied on tight.
  - I sieve well burnt (white) hard wood ashes to remove debris, especially charcoal.
  - These ashes are packed down tightly into the upside down bottle.
  - The bottle is hung in its harness suspended from the tripod.
  - I put a ceramic bowl under the bottle's mouth to catch the lye drip.
  - Water is added little bits at a time (1/2 – 1 cup) to thoroughly soak the ashes and dissolve the lye.
  - Go slow, it should take some hours, sometimes until the next day, before the first drips start.
  - Keep adding water at intervals, but only enough to create a slow, intermitted drip.
  - The collected lye solution will be brown, when the drip starts running clear stop adding water.
  - Slowly pour the brown lye solution through again, to remove most of the coloring organic compounds.
  - Heat the lye water in a pot until steaming to evaporate excess water, until at least half is evaporated.
- Now you're ready to cook some Medieval soap!

### BIBLIOGRAPHY

"Mappae Clavicula", A little Key to the World of Medieval Techniques; Cyril Stanley Smith and John G. Hawthorne. Transactions of the American Philosophical Society Held at Philadelphia for Promoting Useful Knowledge, New Series - Volume 64, Part 4 1974.

The first recipe starts at the capital "C" on p. 129 and ends on p. 130.

The second recipe is on p. 115 (chapter 64) starts at line 21.

For original Latin manuscript: <http://www.cmog.org/library/manuscript-mappae-clavicula>

"Tractatus de Magnetate et Operationibus eius", Reynolds Historical Library at the University of Alabama at Birmingham.

<http://www.uab.edu/reynolds/collect/manuscripts/tractatus/folios/54-tract22v>

"Modern Views on the Constitution of Soap" by Dr. J. Lewkowitsch, page 590-593  
Journal of the Society of Chemical Industry, New York Section, June 15, 1907

"Caveman Chemistry" by Kevin M. Dunn 2003 ISBN 1-58112-566-6

"Historical Lye Making, part 1 & part 2"

<http://homesteadlaboratory.blogspot.com/2014/02/historical-lye-making-part-1.html>

"The Foxfire Book" edited by Eliot Wigginton, Anchor Books, 1972

"Colonial Craftsmen and the Beginning of American Industry" by Edwin Tunis

B&W photo: "Pioneer Children of Appalachia" by Joan Anderson, George Ancona (Illustrator)

Pen drawn images: "Colonial Soap Making; its History and Techniques" at [www.alcasoft.com](http://www.alcasoft.com)