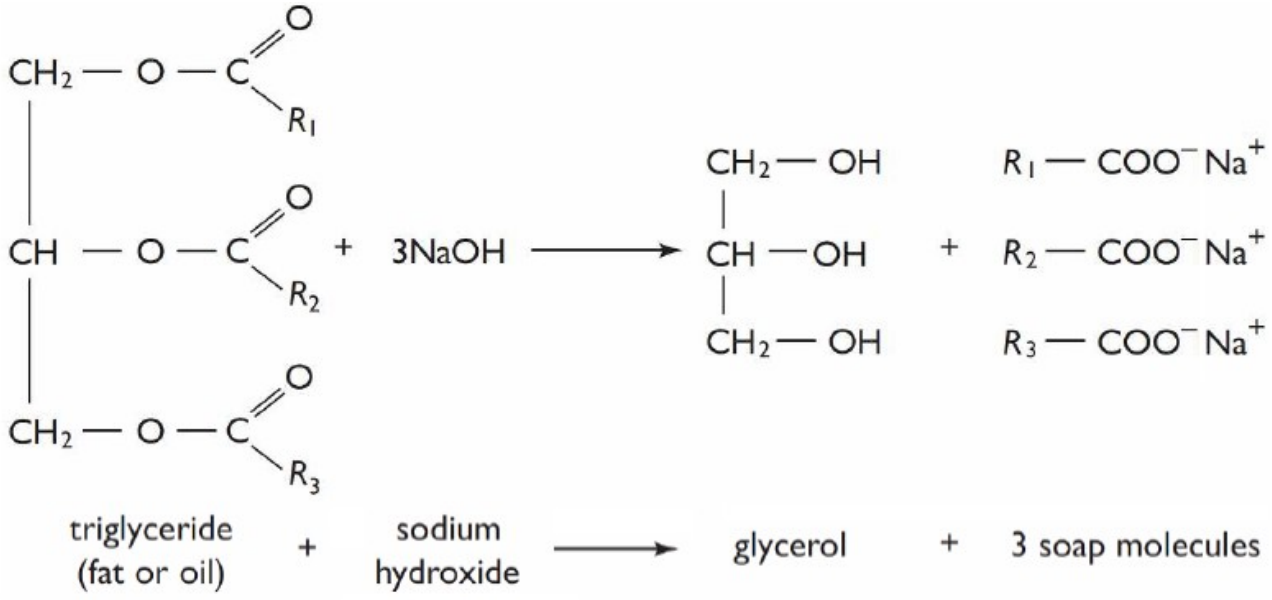
Soap

Historically, soap was a home-made item. Our ancestors would make lye (a caustic solution of NaOH) by passing water through fire ashes. They would then mix the lye with lard in a suitable ratio to produce soap as illustrated in the upper part of the diagram shown below.

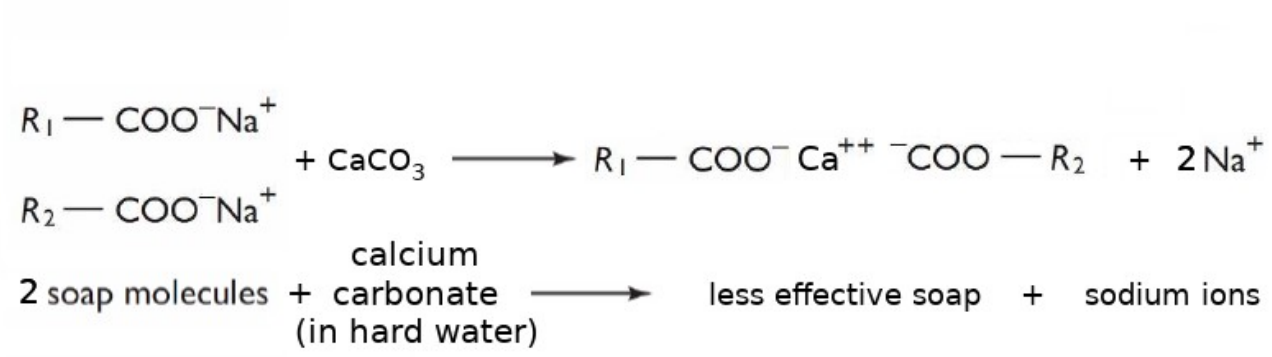
As shown in the diagram, the Na^+ ions from the lye break the bond between the glycerol and the fatty acids in triglycerides putting OH^- ions in place of each fatty acid. The long hydro-carbon tail of the fatty acids is attracted to the grease in grime (grease + dirt) while water molecules and the Na^+ ions are attracted to the COO^- end. This allows agitated water to pull apart the grime.

However, if the soap is used with water that has Ca^{++} (or Mg^{++}) ions in it, their double charge will tie up the COO^- ends of **two** soap molecules making it more difficult for water molecules to pull on those ends. The soap is then much less effective and becomes a scum around the washing area. This is illustrated in the lower part of the diagram shown below.

People sometimes add sodium to their hard water to overwhelm the effect of the Ca^{++} and Mg^{++} ions, but the waste water will then be salty and can be a problem for plants when discharged to the environment.



Making Soap



Using Soap in Hard Water