A LCA case study of hand washing with liquid and bar soap

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Goal and methodology

As part of an introductory course in Life Cycle Assessment (LCA), at ESU-services in Zurich, this case study analysis and compares the life cycle *"from cradle-to-grave"* of liquid- and bar hand soap. We studied the following processes:

1. The production of **1 kg liquid hand soap** from rape seed oil and NaOH, packaged in a PET dispenser.
2. The production of **1 kg bar hand soap** from tallow and NaOH, wrapped in foil and with glycerol as co-product,.
3. The comparison of 1 to 2 expressed in **1000 hand-washing cycles**. (2.3g liquid soap+0.64l water/ cycle, 0.35g bar soap+0.91l water/cycle [2])

The aim of this LCA is to describe in what way and how much the above enumerated processes affect the climate expressed in $kgCO_2$ equivalent over a period of 100 years. Therefore we used the method that describes the impact on climate, based on **IPCC 2013**. The system geographical boundary is **Switzerland**. For each goal we include energy use, transport to retailer and waste management. For bar soap, the purification of tallow and glycerol is not included. For the comparison we include the home transport of the hand soap by the consumer and drying hands with paper tissues.

Data and tools

We used generic data from the ecoinvent V2.2 database and literature data [1, 2, 3]. The software tool SimaPro 8 developed by PRé Consultants is used to model the LCA for both types of soap.

Literature

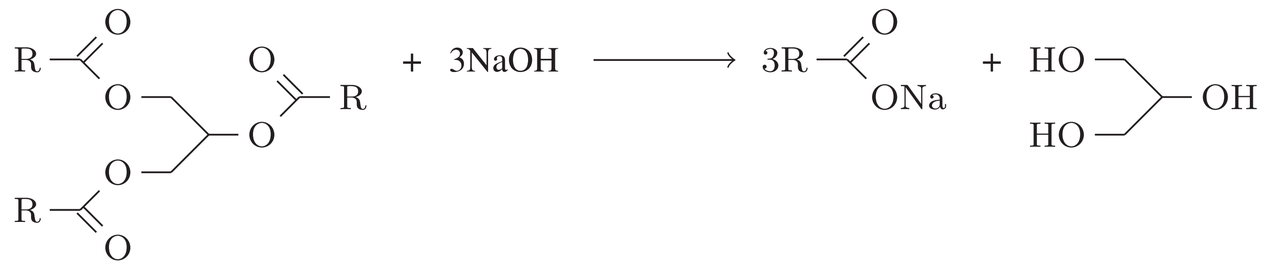
[1] Escamilla, M. et al (2012) 'Revision of European Ecolabel Criteria for Soaps, Shampoos and Hair Conditioner' , in *Tech report*

[2] Koehler, A., Wildbolz, C. (2009) 'Comparing the Environmental Footprints of Home-Care and Personal-Hygiene Products: The Relevance of Different Life-Cycle Phases' , in *Environ. Sci. Technol*, vol.43, no.22, pp. 8643-8651

[3] Ramachandran, H., Amirul, A. (2013) 'Evaluation of unrefined glycerine pitch as an efficient renewable carbon resource for the biosynthesis of novel yellow-pigmented P(3HB-co-4HB) copolymer towards green technology' , in *Biotechnology and Bioprocess Engineering*, vol.18, no.6, pp. 1250-1257

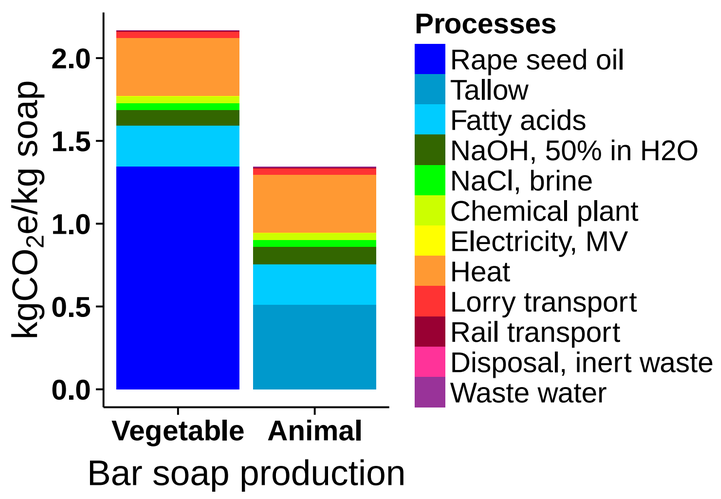
Soap production

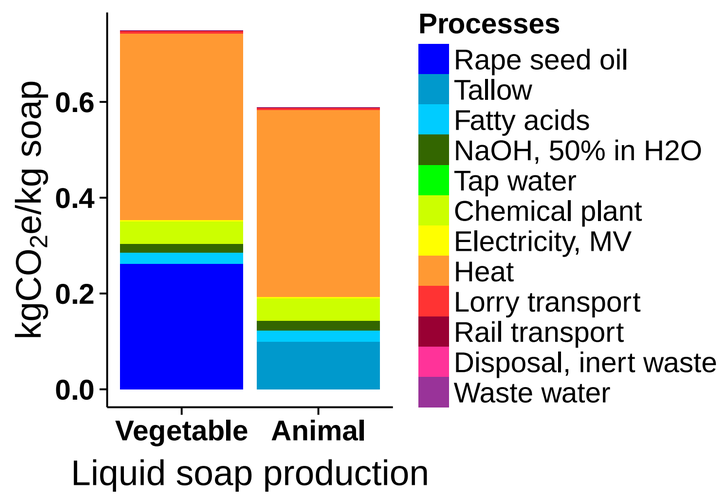
Soap is produced through a process called saponification. Fatty acids in fats/oils are hydrolysed with a base such as NaOH to produce a fatty acid salt (soap) and glycerol.



Results & conclusion

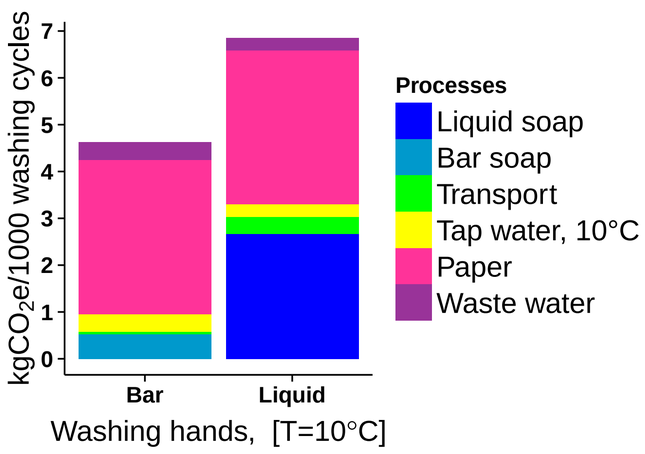
A comparison between soap production from animal fat and soap from vegetable oil.

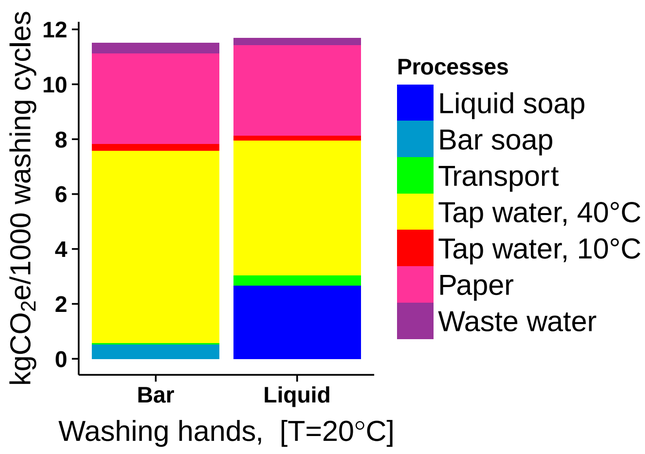


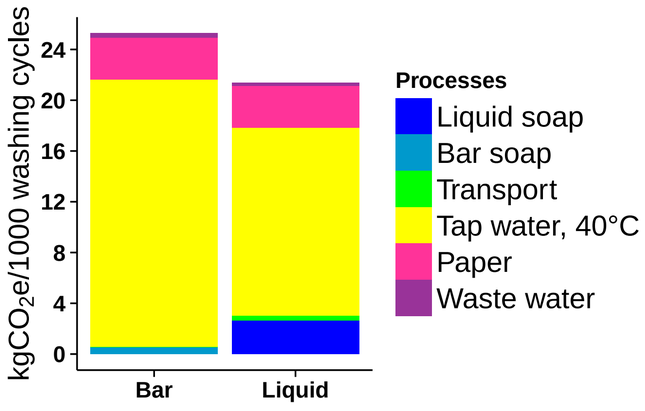


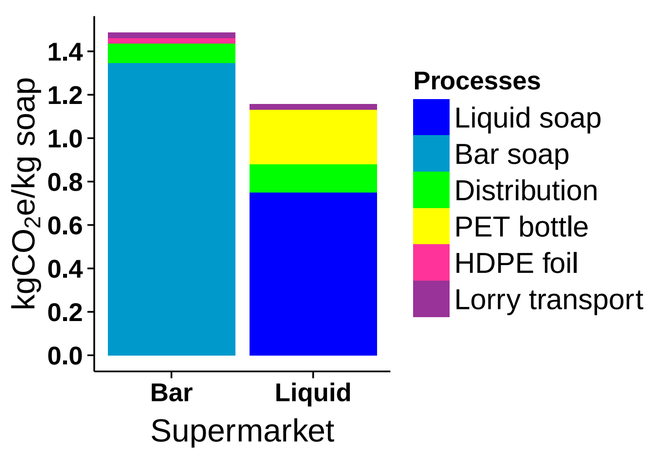
- The production of animal soap results in a lower climate impact/kg soap because animal fat is considered a waste product
- The climate impact of bar soap is higher because it requires more raw materials.

Liquid soap from vegetable oil and bar soap from animal fat. a-c: Hand washing at different temperatures d: Soap at the supermarket.









- During the soap life cycle, the consumer phase shows the highest climate impact.
- In the consumer phase water T(°C) matters; washing hands with cold water results in a higher climate impact for liquid soap because more soap is wasted per washing cycle; washing hands with warm water means a higher climate impact for bar soap because more water is wasted per washing cycle.[2]
- PET packaging has a higher climate impact than HDPE foil, here mainly due to a higher weight.