Periodic graphics

A collaboration between C&EN and Andy Brunning, author of the popular graphics blog Compound Interest

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To see more of Brunning’s work, go to compoundchem.com.
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SOAP VERSUS BODY WASH

Soap and body wash both clean in the same way but use different substances to do so. Here, we take a look at the chemical similarities and differences between the two.

**COMMON CHEMISTRY**

Soaps and body washes contain surfactants. These are molecules with one end that dissolves in water (hydrophilic) and another that dissolves in oils and grease (hydrophobic).

**HYDROPHOBIC**

**HYDROPHILIC**

Surfactants lower the surface tension of water, creating foam, and emulsify oils and grease so they can be washed away.

**SKIN** pH 4.5–5.5

Soap pH 8.0–11.0

Body Wash pH 4.0–6.0

Skin pH is slightly acidic. Soap is alkaline and can have a drying effect, while body washes have a pH closer to skin’s.

**SOAP**

Reacting fats or oils (triglycerides) with water-soluble bases generates soap surfactants and glycerol, a useful by-product.

**BASE**

NaOH or KOH

**SOAP**

Na⁺ \( \text{O}^- \text{O}^{-} \text{O}^- \text{R}^1 \text{R}^2 \text{R}^3 \)

**GLYCEROL**

\( \text{OH} \)

**TRIGLYCERIDE**

\( \text{R}^1, \text{R}^2, \text{R}^3 = \text{chains containing 15–19 carbons} \)

Using sodium hydroxide as the base creates solid soaps, such as sodium stearate. Using potassium hydroxide creates liquid soaps.

**SODIUM STEARATE**

Hard water plus sodium stearate creates soap scum (calcium and magnesium stearates).

**BODY WASH**

Body wash and shower gels often use salts of lauryl sulfates and laureth sulfates as primary surfactants.

**SODIUM LAURETH SULFATE**

Cetyl or stearyl alcohol additives can give body washes an opaque appearance. Glycerol stearate produces a pearlescent effect.

**CETYL ALCOHOL**

**GLYCOL STEARATE**

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