

What do alcoholic handrubs contain?

Alcoholic handrubs are the primarily recommended hand hygiene tools according to all large professional organizations. (ABHR = Alcohol-based handrub, according to the WHO terminology.) These contain alcohol as active ingredient; **ethanol**, **propan-1-ol**, **propan-2-ol** or the combination of these. These three alcohols have several alternative names, some may sound more familiar: the alternative names are listed in *Figure 1*, along with their chemical structures.

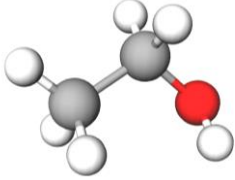
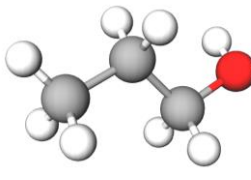
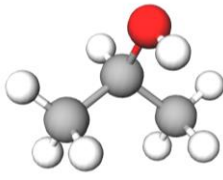
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|--------------------|---|--|---|
| Chemical structure |  |  |  |
| Name | CH ₃ -CH ₂ -OH ethanol | CH ₃ -CH ₂ -CH ₂ -OH propan-1-ol | CH ₃ -CHOH-CH ₃ propan-2-ol |
| Also known as | etil-alcohol, methylcarbinol | n-propanol, 1-propanol, 1-propyl alcohol, n-propyl alcohol | isopropanol, isopropil- alcohol, dimethyl carbinol |

Figure 1: Structure of ethanol, propan-1-ol and propan-2-ol (using the official IUPAC names). Drawings were made by molwiev.org.

The antimicrobial activity of alcohols derives from their ability to denature proteins. According to the WHO, alcohol solutions containing 60–80% alcohol are the most effective [1]. CDC claims that the most effective concentration range is between 60 and 95% [2]. Higher concentrations are less potent, because proteins are not denatured easily in the absence of water.

Alcohols have excellent germicidal activity against Gram-positive and Gram-negative bacteria and a variety of fungi. However, they have very poor activity against some non-enveloped viruses (e.g.: Adenovirus, Norovirus), and almost no activity against bacterial spores (e.g.: *C. difficile*) or protozoan oocysts [1].

| | Concentration (%) | | | |
|-----------------------------------|-------------------|-------------|-------------|--|
| | Etanol | Propan-1-ol | Propan-2-ol | Other active ingredients |
| Alsoft E (Saraya) | | <15% | <65% | Polyhexamethylene biguanide hydrochloride (<0.25%) |
| Aniosgel (Anios) | 50–100% | | 0–2.5% | |
| Aseptoman (Dr. Schumacher) | | | <65% | |
| Desderman (Schülke) | 78% | | 10% | Biphenyl-2-ol (0.1%) |
| Desmanol (Schülke) | | 32% | 21% | Chlorhexidinedine (<1%) |
| Hibi (Molnlycke) | | | 30–60% | Chlorhexidinedine (<0.5%) |
| InstantFoam (Deb) | 60–100% | 10–30% | <1% | |
| Manusept (Hartmann) | 70–90% | | | |
| Purell (GOJO) | 50–70% | | 1–5% | |
| Skinman Complete (Ecolab) | 50–100% | | | |
| Softa-Man (B.Braun) | <55% | <25% | | |
| Sterillium (Hartmann) | | 30–50% | 30–50% | 1-Tetradecanol (<1%), Mecetronium etilsulfate (<1%) |
| WHO's own formulation | 80% | | | Hydrogen peroxide (0.1%) |

Figure 2: Active ingredients of some commercially available handrubs.



Alcohols are quick germicidals, when applied to the skin, but have no residual activity. Regrowth of bacteria occurs gradually after the hand hygiene event. Addition of chlorhexidine, quaternary ammonium compounds, octenidine or triclosan to handrubs can result in persistent activity [1]. Composition of some commercially available handrub are shown in *Figure 2*.

Conclusion:

Handrubs contain different kind of alcohol(s) to denature the proteins of germs and different additional components to elongate the germicidal activity. Commercially available handrubs have very different compositions. In the next post, we will discuss how we can compare the effectiveness of these products.

References

- 1: WHO Guidelines on Hand Hygiene in Health Care. ISBN 978 92 4 159790 6. 2009
- 2: Boyce J.M. and Pittet D.: CDC Guideline for Hand Hygiene in Health-Care Settings.