

Alcohols

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The term *alcohol* is derived from the Arabic *al kohl*, a term for the antimony sulfide used by ancient Egyptians to treat eye infections in newborns. The alchemist Paracelsus in the Middle Ages applied the name *al-kool* to the antiseptic properties of wine. Alcohol is perhaps the oldest of antiseptic agents, being recommended for wound treatment by Claudius Galen (131–201 AD) and Guy de Chauliac (1363). Beck (1990) reviewed the history of alcohol use as an antiseptic.

The first scientific investigation of the antimicrobial properties of alcohol was likely the ethanol studies of Buchholtz (1875), which suggested possible antiseptic use. Subsequently, Koch and Koch (1881) concluded that ethanol was ineffective as an antiseptic based on his work with anthrax spores. Nealon (Beck, 1984) first applied alcohol to preoperative skin disinfection in the nineteenth century. Fürbringer recommended alcohol as a hand disinfectant for surgeons in 1888 (Rotter, 1996b).

In many parts of Europe, the use of alcohols has remained the standard for hand and skin antiseptics since the early part of this century (Rotter, 1996b). Prevailing practices in the United States, however, have cycled over time. Ethanol was a preferred skin antiseptic in the 1930s. Price (1938a, 1939, 1950a,b, 1951, 1959) demonstrated the antiseptic performance of alcohol in a series of reports from 1938 through 1950. His survey of 1948 (Price, 1950) indicated 64% of U.S. hospitals used ethanol for skin disinfection. By 1965, this rate had declined to 18% (King and Zimmerman, 1965), and by 1992 alcohols were seldom used for skin and especially hand antiseptics.

Today, alcohols are not primary skin antiseptics in North America, having been replaced by antiseptic

preparations containing various active ingredients, including iodophors, chlorhexidine gluconate, phenolic derivatives [*p*-chloro-*m*-xylenol (PCMX), triclosan], and quaternary ammonium compounds (benzyl/benzalkonium chlorides). Some reversal of this trend began in the late 1980s with the introduction of alcohol-based "hand sanitizers." These products, which contained 60% to 70% ethanol, isopropanol, or mixtures thereof in a gelled form, were designed for use as hand antiseptics in medical and food-handling situations. Their use increased slowly but steadily until 1997, when they were launched into the consumer retail setting in the United States and Canada. Currently (i.e., 1999), use of ethanol-based hand sanitizers is growing in both the professional and consumer arenas worldwide. A few isopropanol-based products (sprays and hand dips) are used in the food industry.

Alcohols have been used as hard surface (nonskin) disinfectants. Whereas the lack of sporicidal effect limits sterilization applications for alcohols, their general antimicrobial properties can be useful against surface-borne bacteria and other microorganisms. Seventy-percent isopropanol is used as a surface spray in some food-handling situations. A variety of available surface-disinfectant sprays claim effectiveness against bacteria, yeast, fungi, and some viruses. Given the volatility and time-exposure requirements of alcohol, some of these claims are questionable.

Although alcohols are now nearly universally recognized as effective antimicrobial agents, the history of alcohol use for antiseptics, disinfection, and sterilization is replete with controversy in light of seemingly contradictory findings. Issues such as spectrum of activity, concentration levels, time of action, and formulations have been routinely argued in the literature, and practices have varied widely. These differences most always can be traced to methodology and situational factors. It is critically important to specify experimental conditions in detail when considering the antimicrobial aspects of alcohols.

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