

Coronavirus versus 70% Alcohol: Comments and Some Fundamental Definitions

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The new coronavirus pandemic (COVID-19) is a global problem that is having severe impacts on health systems worldwide. One particular characteristic of this virus is its high transmission rate, which has led to a high demand for personal care materials such as masks, gloves, and alcohol for asepsis. Seventy percent is the ideal concentration for the ethanol used in hand sanitizers; however, this concentration can be expressed in different ways, and, consequently, the different solutions will have different antiseptic activity. In this manuscript we comment on some characteristics of alcohol-based preparations and the different ways of expressing the concentrations.

Keywords: SARS-CoV-2. COVID-19. 70% ethanol.

INTRODUCTION

SARS-CoV-2 is a variant of the coronavirus family, and it is responsible for the COVID-19 disease. Due to it being another type of coronavirus, SARS-CoV-2 can infect humans (WHO, 2020a). On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic (WHO, 2020b; WHO, 2020c). Italy was one of the most affected countries, due to its large number of elderly people, who account for 22.1% of the population (CIA, 2020). The elderly and people with chronic diseases (e.g., immunosuppressed people, and those with heart and cardio-respiratory problems, diabetes, and autoimmune diseases) are the groups most at risk of being affected by COVID-19 (WHO, 2020a) — a situation that alarmed public sectors and the general population as well. The recommendations adopted by both the Brazilian Ministry of Health Care and control agencies were the same as those suggested by the WHO, including the use of 70%

alcohol gel in asepsis and hand hygiene (WHO, 2020a; Brasil, Ministério da Saúde, 2020).

TECHNICAL COMMENTS

At this critical moment, the veracity of information and appropriate interpretations are fundamental for ensuring quick control of COVID-19 propagation; however, there is inaccurate information and uncertainties surrounding the ethanol concentration in antiseptic alternatives. Different concentration forms, expressed in percentage, can be found in the literature or in recommendations from authorities; for example, 70% volume per volume (v/v) (Kampf, 2018), weight per volume (w/v) (Andrade *et al.*, 2007), or weight per weight (w/w) (Kampf, 2018; Venturelli *et al.*, 2009). On the homepage of the Brazilian Federal Chemistry Council (*Conselho Federal de Química* — CFQ), there are two official notes about coronavirus and use of 70% ethanol, each one with a different concentration: 70% v/v (CFQ, 2020a) and 70° INPM (CFQ, 2020b). Thus, given the recurring divergence in the information, some clarifications are necessary. The ethanol concentration presented as degrees Gay-Lussac (°GL) is the same

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as v/v; whereas degrees INPM (*Instituto Nacional de Pesos e Medidas* — the Brazilian National Institute of Weights and Measurements) is equivalent to w/w (Brasil, Ministério da Saúde, 2012). Another important piece of information is the convention that a percentage concentration is equivalent to the w/w concentration. Thus, when ethanol concentration is given as 70%, this means that the ethanol's weight corresponds to 70% of the solution's total weight (i.e., it is different to 70% v/v).

In general, formulations of 60 to 95% alcohol (e.g., ethanol, isopropanol, etc.) are referred to in the literature, and these concentrations have been effective against most microorganisms (Kampf, 2018; Harrington and Walker, 1903; Boyce and Pittet, 2002; Price, 1939; Kampf *et al.*, 2020). In terms of general use, 70% ethanol is the most effective antiseptic form available for purchase. The 70% is correctly expressed as percent by weight (w/w) — the solution is exact and invariable, and so the weight is not affected by variables such as temperature, specific gravity, or intermolecular interactions (Price, 1938). When prepared at 15 °C and 25 °C, 70% ethanol (v/v) is equivalent to 62.4% (w/w) and 59.2% (w/w), respectively. This means that 70% ethanol (v/v) solution does not have a sufficient amount of ethanol to ensure the greatest (70%, w/w) antimicrobial activity (Boyce and Pittet, 2002; Price, 1938). To obtain a solution with a final concentration of 70% (w/w), it would be necessary to use 76.8 mL of absolute ethanol for each 100 mL of solution at the v/v ratio.

These discrepancies in the standardization of concentration expressions can lead to mistakes in the final concentrations, which leads to a reduction in the efficiency (e.g. due to the increased demand for contact time) of ethanol solutions or gel (Boyce and Pittet, 2002; Salvage *et al.*, 2014). At a time of global pandemic, all the care possible in preventive action can assist in containing the spread of viruses. For the reasons presented, the purpose of these comments is to alert specialized health agencies and the global population in general about the correct way to express and interpret ethanol concentrations associated with asepsis and hand hygiene.

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