

Oral Communication 2

Development of new phytochemical-based disinfectant formulations for the control of healthcare-associated bacterial infections

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Abstract

Background: Healthcare-associated infections (HAIs) remain a critical public health challenge due to the persistence of multidrug-resistant (MDR) bacteria and the inefficacy of conventional disinfectants [1]. Biofilms further enhance bacterial resistance and limit the effectiveness of biocides [2]. Phytochemicals have emerged as natural alternatives due to their antimicrobial and antibiofilm properties [3]. This study explored the potential of phytochemical-based formulations to enhance disinfection in healthcare settings. **Objective:** This research aimed to assess the antimicrobial efficacy of selected phytochemicals—eugenol (EUG), salicylic acid (SAL), shikimic acid (SHI), trans-m-coumaric acid (COU), and choline chloride (COL)—alone and in combination with widely used biocides, particularly benzalkonium chloride (BAC) and peracetic acid (PAA). **Methods:** The antimicrobial activity of phytochemicals and biocides was tested against *Staphylococcus aureus* and *Escherichia coli* following the European Standard EN 1276 (2019). For this, the dose-response and time-response effects, as well as the minimum bactericidal concentrations (MBCs), were determined. The Checkerboard assay, analyzed with Combenefit software, assessed synergism potential in dual and triple combinations through the Fractional Bactericidal Concentration Index (FBCI). Disinfection kinetics were characterized using the Chick-Watson and Weibull models. **Results:** Among the phytochemicals tested, SAL (with an MBC of 500 mg/L for both bacteria) and EUG (with an MBC of 1000 mg/L for *E. coli* and 1700 mg/L for *S. aureus*) showed the highest antimicrobial efficacy. For both bacteria, MBCs of 3 mg/L and 1 mg/L and high disinfection rates were obtained with BAC and PAA, respectively. BAC combined with EUG (750 mg/L) showed synergistic effects against *S. aureus* (FBCI = 0.309) and *E. coli* (FBCI = 0.350). A synergistic interaction was observed between BAC and EUG, while the other dual combinations exhibited additive effects. Triple combinations demonstrated promising bactericidal activity, effectively reducing bacterial culturability. Maximum reductions of (5.78 ± 0.07) log (CFU/mL) for *E. coli* and (5.82 ± 0.04) log (CFU/mL) for *S. aureus* within 30 minutes were obtained. **Conclusions:** This study demonstrated that phytochemicals could enhance the efficacy of conventional biocides, reducing the required concentrations and contributing to the development of effective and sustainable healthcare disinfection strategies.

Keywords: healthcare-associated infections; phytochemical-based disinfection; synergistic antimicrobial activity

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