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MS Thesis: Antimicrobial coatings for Silicone surfaces

Author: I am from Sri Lanka and came to Iceland in August 2023 to pursue an MSc in Applied Biotechnology at the University of Iceland. My first degree is a BSc in Natural Sciences, and I later completed an MSc in Pharmaceutical Biotechnology in Sri Lanka. I have professional experience working as a secondary school teacher and a medical laboratory technician. I began the MSc in Applied Biotechnology at the University of Iceland in September 2023. For my research project, titled **"Antibacterial Coatings for Silicone Surfaces,"** I focused on optimizing silicone surface activation and developing antimicrobial coatings. The project involved evaluating the antimicrobial efficacy of natural biopolymers and exploring the use of cyclodextrins.

Short summary: Surface modification of silicone has emerged as a promising approach to enhance the antimicrobial functionality of medical devices. This study explored chemical activation methods for silicone surfaces to improve the adhesion and efficacy of naturally derived antimicrobial coatings. While the original aim was to assess antifungal properties, the focus shifted to antibacterial activity due to logistical delays. Standard bacterial strains were used to evaluate efficacy, employing both colony-forming unit quantification and biofilm staining methods. Activation protocols enhanced surface reactivity and significantly improved the antimicrobial effects of the coatings, particularly under light exposure. One activation method yielded consistent results and enabled strong antibacterial effects, with one coating achieving nearly a 3-log reduction in S. aureus, equivalent to approximately 99.9% bacterial inhibition. Although initial results suggested one additive enhanced performance, this was later attributed to material contamination, as effects were not reproducible. The findings support the potential of silicone surface activation combined with biopolymer coatings as a platform for antimicrobial surfaces. Further studies should address coating durability, antifungal performance, and contamination-resistant testing methodologies.