Elastomeric silicone foam - an antibacterial environment or a new habitat for bacteria?

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Silicone is often used in environments where water repellency is an advantage. Contact with water promotes the adhesion of microorganisms and biofilm formation. Depending on the application, this may increase the possibility of infections, the material's degrading appearance, and the likelihood of manufacturing defects. The prevention of microbial adhesion and biofilm formation is also essential for silicone-based elastomeric foams, which are used in direct contact with human bodies but are often difficult to clean[1].

We compared the microbial attachment in and the retention from the pores of silicone foams of different compositions to those of commonly used polyurethane foams (Fig. 1). The growth of the gram-negative *Escherichia coli* in the pores and their leaching during wash cycles is characterised by bacterial growth, adhesion assay, and SEM imaging (Fig. 2). Despite using common antibacterial additives, we have found that non-soluble particles stay isolated in the silicone elastomer layer even upon expansion of the foam. Although such particles do not surface, there is still a considerable growth-inhibiting effect, e.g. for chitosan. Water-soluble tannic acid dissolves into the medium and seems to aid in inhibiting planktonic bacterial growth, indicating that tannic acid is available on the surface of the SIFs to some extent[2]. As a highly hydrophobic material, pristine silicone is prone to bacterial growth[3], inhibiting adhesion by modifying the elastomer surface affects the bacterial formations of the surface. These additives can be used as relatively cost-effective fillers and fire-retardant agents, so their antimicrobial properties are gaining more importance. Due to the increasing cost of rare metals, we have been seeking solutions for more economical and sustainable production, using natural organic and inorganic additives. Our results offer new insights into the possible mechanisms of bacterial adhesion and will be an exciting source of knowledge for researchers and the silicone foam industry.

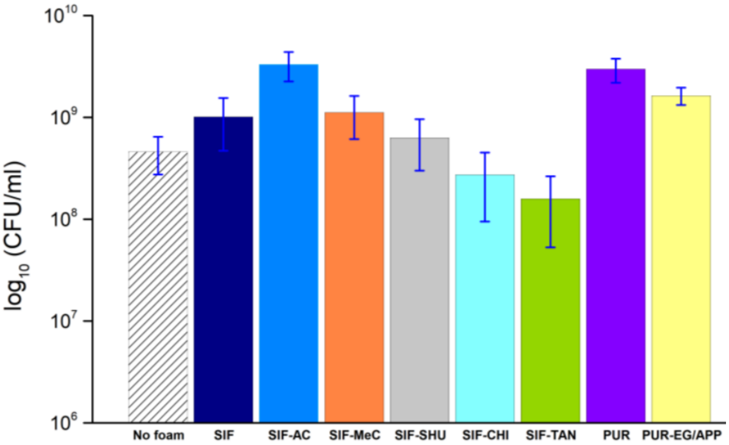

Figure 1. The E. coli concentrations in the growth mediums around foams after 24h incubation period.

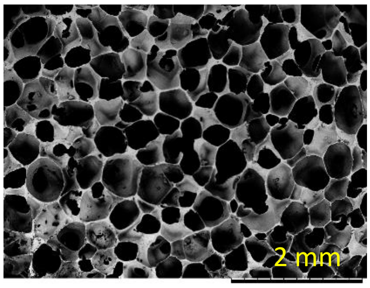

Figure 2. Open porosity as a pathway for E. coli.

References

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