Anionic Block Polymers as Next-Generation Broad-Spectrum, Self-Sterilizing Antimicrobial Surfaces

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ABSTRACT

Some of the challenges currently facing the global community are becoming increasingly life-threatening and chronic. For instance, infectious microbes such as methicillin-resistant *S. aureus* (MRSA) constitute major healthcare concerns as invisible predators primarily, but not restricted to, stalking the elderly and immune-compromised. In addition, the acute outbreak involving SARS-CoV2 has resulted in a lingering pandemic that continues to ravage the world's population. While some pathogens spread by dispersed water droplets or aerosols during coughs or sneezes, many survive on surfaces for several days or weeks, in which case transmission can alternatively occur upon contact with contaminated surfaces. In response, various surface-disinfecting methods involving nanoparticles or chemical functionalization have been proposed to combat this menace, but many target specific chemical moieties on specific microbes or promote environmental contamination. In this work, we discuss a novel and promising antimicrobial strategy wherein charged thermoplastic elastomers (TPEs) are capable of promoting a dramatic pH jump near the polymer/water interface, resulting in a highly acidic surface environment that rapidly causes microbial inactivation. In the presence of water, this system inactivates at least 99.9999% of several Gram-positive/negative bacterial strains and three viral strains in less than 5 minutes at ambient temperature. It is also highly effective against SARS-CoV-2 and another coronavirus and is currently being used in high-touch areas in several domestic airports. This method provides an effective and unexplored pathway to broad-spectrum anti-infective materials that are recyclable and eco-friendly. Since the properties of these TPEs are tied to their structure, their morphological characteristics will also be briefly discussed.