22.4.2 Antimicrobial Surfaces

The use of antimicrobial surfaces to prevent nosocomial infections is currently under investigation. To manufacture these surfaces, materials are coated with both antimicrobial and anti-adhesive compounds to keep them germ-free. Consequently, treated surfaces will pose a lesser infection risk for patients. Microbial adhesion is generally prevented by covering the surface with a layer of compounds that creates a hydrophilic environment and hinders hydrophobic interactions between bacterial cells and the surface. This can be achieved using polyethylene glycol (PEG), diamond-like carbon (DLC), and zwitterionic head groups (Park et al. 1998; Cheng et al. 2007). Additionally, these surfaces are coated with heavy metals that exhibit antimicrobial properties. The most common metals used are silver and copper. Although the antibacterial efficacy of silver-coated surfaces in hospitals has not been assessed extensively yet, there are multiple examples that support the antimicrobial activity of this metal in catheters and other medical devices (Chaloupka et al. 2010). Regarding the use of copper-coated surfaces in hospitals, there are several studies that have shown good results (Casey et al. 2010). However, a potential problem related to widespread use of metal-coated surfaces would be the development of resistance to copper and/or silver (Percival et al. 2005; Dupont et al. 2011).

Antimicrobial surfaces can also be engineered by coating with other disinfectants such as triclosan and quaternary ammonium compounds. The main drawback of these surfaces is the release of these compounds into the environment, which could promote resistance acquisition. Finally, there are some new antimicrobials, like polycationic peptides (polyethyleneimines [PEIs]), that can be used to coat surfaces, but more research is still required to rule out toxic effects and to confirm their stability (Klivanov 2007).

22.4.3 Biological Disinfectants

22.4.3.1 Bacteriophages or Phages

Bacteriophages or phages are viruses that exclusively attack bacteria. Their antimicrobial potential is well known, and multiple applications are currently under investigation, the most notable being as an antimicrobial agent (O'Flaherty et al. 2009). Regarding the prevention of bacterial contamination, bacteriophages have been successfully attached to different materials used to manufacture medical devices like catheters (Curtin and Donlan 2006) and biodegradable polymers (Jikia et al. 2005) (Markoishvili et al. 2002). The main drawbacks of bacteriophage-containing materials are the high specificity of phages for their target host and the potential development of bacterial resistance. Both problems can be solved by using mixtures of phages with different host specificities. Thus, mixtures of phages have a wider host range and drastically reduce the frequency to find bacteria resistant to all the phages. In