Prevention of Healthcare Associated Infections using Antibacterial Boron Carbonitride Nanoparticle Coating on Medical Devices

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Annually in the U.S., over 1 million hospitalized patients acquire surgical site infections (SSIs), urinary tract infections (UTIs), or central line associated bloodstream infections (CLABSIs) of which approximately 50,000 result in deaths, contributing to over $30 billion in healthcare costs. The current use of antibiotics in treating healthcare acquired infections contributes to the development of multidrug-resistant "superbugs". This study evaluated the application of Boron carbonitride (BCN) as an antibacterial nanoparticle coating on orthopedic implants, central venous catheters, urinary catheters, surgical sutures, and wound dressing. BCN toxicity studies were conducted on cells involved in wound healing. Additionally, durability and integrity of BCN coating was also tested. Thin films of BCN were deposited onto medical devices by reactive RF magnetron sputtering. Segments of medical devices were immersed in live suspensions of S. epidermidis, and E. coli. After 6 hours, segments were rinsed and plated on nutrient agar. Total number of colony forming units (CFUs) was counted after 24 hours of incubation. For the toxicity assay, primary human epidermal keratinocytes were grown on uncoated and BCN coated TegadermTM and viable cells were counted after 96 hours of incubation. Integrity of BCN coating after repeated use was assessed using scanning electron microscopy. There was a statistically significant decrease in mean CFUs of S. epidermidis and E. coli . on all BCN coated devices, with percent reduction in CFUs ranging between 79 and 91%. Additionally, keratinocyte viability was not affected by BCN coating, suggesting no toxicity or interference with wound healing. Integrity of BCN coating and surface features were durably retained on devices after repeated use.

Awards Won:

Second Award of $2,000

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