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Self-assembly of natural protein and imidazole molecules on gold nanoparticles: Applications in wound healing against multi-drug resistant bacteria

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Abstract

Developing highly active and green antibacterial agents for pathogens, especially multidrug-resistant superbugs, is vital for solving the problem of serious antibiotic resistance. Herein, we report a unique system of gold nanoparticles coated with chicken egg white (CEW) and 2-mercapto-1-methylimidazole (MMT) as a novel antibacterial agent. The CEW was used to prepare the gold nanoparticles as a commercially available reducing and stabilizing agent, and then the MMT self-assembled on the surface of nanoparticles. The resulting Au@CEW/MMT was found to be a highly efficient antibacterial agent, and the activity is mainly attributed to the synergistic effects of MMT and Au@CEW in undermining the bacterial membrane. Meanwhile, the studies of antibacterial activities and biocompatibility of Au@CEW/MMT with different ratios of MMT conjugation to Au@CEW confirmed that Au@CEW/MMT₃ (MMT:HAuCl₄ = 1:50) can maintain a balance between antibacterial properties and biocompatibility. Furthermore, in an in-vivo study using the rabbit model, gauze loaded with Au@CEW/MMT₃ can effectively accelerate the healing of wounds infected with methicillin-resistant *S. aureus* and promote the formation of collagen. Therefore, this work illustrated a promising material with broad-spectrum

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