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Bitao Lu, Fei Lu, Luoxiao Ran, Kun Yu, Yang Xiao, Zhiquan Li, Fangying Dai, Dayang Wu, Guangqian Lan

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

Bitao Lu[a,1], Fei Lu[a,b,1], Luoxiao Ran[a], Kun Yu[a], Yang Xiao[c], Zhiquan Li[c], Fangying Dai[a,b], Dayang Wu, Guangqian Lan[a,b]*

[a]College of Textile and Garments, Southwest University, Chongqing 400715, China

[b]Chongqing Engineering Research Center of Biomaterial Fiber and Modern Textile, Chongqing 400715, China

[c]Sericulture & Agri-Food Research Institute of Guangdong Academy of Agriculture Science, Guangzhou 510610, China

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:$HAuCl_4$ =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/MMT_3 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

*Corresponding author: College of Textile and Garments, Southwest University, Chongqing 400715, China. Phone: +8613594005200; fax: +8602368251228; e-mail: 30353930@qq.com
[1]Equally contributed.