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Facile Synthesis, Structure, Biocompatibility and Antimicrobial Property of Gold Nanoparticle Composites from Cellulose and Keratin

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ABSTRACT

A novel, one-pot method was developed to synthesize gold nanoparticle composite from cellulose (CEL), wool keratin (KER) and chloroauric acid. Two ionic liquids, butylmethylimidazolium chloride and ethylmethylimidazolium bis(trifluoromethylsulfonyl)imide were used to dissolve CEL, KER and HAuCl₄. X-ray diffraction and X-ray photoelectron results show that Au³⁺ was completely reduced to Au⁰NPs with size of (5.5 ± 1) nm directly in the composite with NaBH₄. Spectroscopy and imaging results indicate that CEL and KER remained chemically intact and were homogeneously distributed in the composites with Au⁰NPs. Encapsulating Au⁰NPs into [CEL+KER] composite make the composite fully biocompatible and their bactericide capabilities were increased by the antibacterial activity of Au⁰NPs. Specifically, the [CEL+KER+Au⁰NPs] composite exhibits up to 97% and 98% reduction in growth of antibiotic resistant bacteria such as vancomycin resistant *Enterococcus* and methicillin resistant *S. aureus*, and is not cytotoxic to human fibroblasts. While [CEL+KER] composite is known to possess some antibacterial activity, the enhanced antibacterial observed here is due solely to added Au⁰NPs. These results together with our previous finding that [CEL+KER] composites can be used for controlled delivery of drugs clearly indicate that the [CEL+KER+Au⁰NPs] composite possess all required properties for successful use as dressing to treat chronic ulcerous infected wounds.

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