

New Technology Based on Combination of Cryogel and Nanoparticles for Wound Management

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INTRODUCTION

The anti-microbial properties of noble metals have been known since ancient times. The new technology allows obtaining metal particles with programmed size and shape. Gold and silver nanoparticles have been employed for various bio-medical applications (1, 2, 3). In our study we developed the method of obtaining gold and silver nanoparticles with different shape. The nanoparticles are to be incorporated into the cryogel, which provides an ideal antimicrobial micro-environment for effective wound healing.

EXPERIMENTAL METHODS

Silver nanoparticles have been synthesized using sodium borohydride reduction of silver nitrate. The synthesis of gold nanoparticles for this method has been realized through Turkevich method (4). Turkevich method has been known as one of the oldest and most popular procedures for obtaining gold nanoparticles of 10-15 nm diameters in the water. Produced silver nanoparticles and gold nanoparticles were imaged by Tunnelling Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM).

RESULTS AND DISCUSSION

Initially we have developed several methods for synthesizing gold and silver nanoparticles of varying shapes and sizes. We have achieved production of triangular and circular nanostructures made of noble metals. We do hypothesize that shape of the particle affects its anti-microbial properties.

As a second step, experiments for conjugating the metal nanoparticles to the surface of cryogel have been conducted. It has been achieved through formation of strong covalent bonding between gold nanoparticles and cysteamine. By following cysteamine functionalization to gold nanoparticles surface, we were able to form NH₂ bond sticking out of the surface. This was done in order to make sure that the nanoparticles are well attached and do not get detached from the surface.

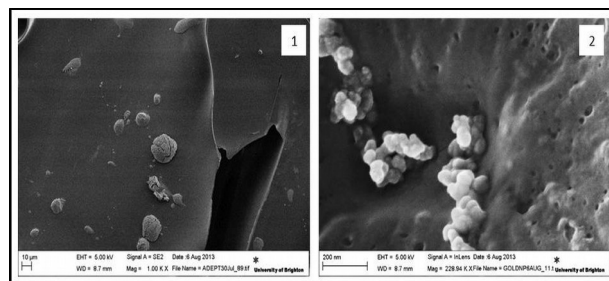


Figure 1. SEM image Attached gold nanoparticles on the surface of a cryogel.

Figure 2. SEM image Aggregated gold nanoparticles on the surface of a cryogel.

CONCLUSION

The manufacturing of several types of nanoparticles with programmed shape and size (made of noble metals) has been established. The form of particles has been confirmed by SEM and TEM imaging. Produced nanoparticles were attached to the surface of cryogel by forming bonds between cysteamine and noble metals. The obtained composition 'metal-cryogel' provides a perfect foundation for developing new type of wound dressings. The noble metals ensure an anti-microbial effect, whilst macro- and mesoporous structures of the cryogel provide an optimal environment for the process of wound healing by absorbing exudate and debriding the wound.

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