



Paper #56

## **Antibacterial and Biocompatible Titanium-copper-oxide Nanofilm Coating**

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**Introduction:** Copper has been approved as a surface antibacterial material by the Environmental Protection Agency and has superior in vitro antibacterial and biocompatible performance compared with other metals.

**Methods:** Custom made Ti6Al4V Eli discs of 1.25 mm thickness and 12.5mm diameter were coated with TiCuO<sub>2</sub> nanofilm loaded with 20% and 40% of copper using physical vapor deposition (PVD). For cell viability experiments, normal human osteoblast cells were seeded at a density of  $1.8 \times 10^4$  cells per well. After 2 days, discs were incubated with cells under 2ml osteoblast cell media. At 72 hours, cell viability MTS assay was performed. For antibacterial analysis, discs were submerged in 2 ml of RMPI media and 10% fetal calf serum. Staphylococcus epidermidis inoculum of  $3.1 \times 10^5$  CFU/ml was added to the discs. After 24 hours, discs were removed, rinsed, placed into 1 ml sterile saline, vortexed and sonicated. Biofilms and planktonic cells were quantitatively cultured. Copper release from the nanofilms was measured using an Inductively Coupled Plasma Mass Spectrometer (ICP-MS) at day 1, 2, 3 and 7.

**Results:** No cell viability detriment was shown at 72 hours of exposure to TiCuO<sub>2</sub> coated discs at any copper concentration. Indeed, it was a slightly increase of cell viability after exposure to TiCuO<sub>2</sub>-coated discs. TiCuO<sub>2</sub>-coated discs loaded with 20% and 40% showed statistically significant 1.5 log<sub>10</sub> and 2 log<sub>10</sub> reduction of biofilm forming bacteria when compared with uncoated control discs, respectively (t-test,  $p < 0.001$ ). Only TiCuO<sub>2</sub>-coated discs loaded with 40% of copper showed statistically significant 0.83 log<sub>10</sub> reduction in planktonic bacteria (t-test,  $p < 0.001$ ). Release of copper from TiCuO<sub>2</sub> nanofilm containing 20% and 40% reached a maximum of 0.7 and 3.3 $\mu$ g/dL during first 24 hours, respectively. Later, the amount of copper released was low.

**Conclusion:** TiCuO<sub>2</sub> nanofilm loaded with 20 and 40% of copper showed antibacterial effect while maintaining biocompatibility. This bioactive coating could be a promising approach for use in the field of implants-related infection.

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