



# Bioactive Gentamicin-Eluting Composite Coatings on Titanium



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## INTRODUCTION

- Multifunctional implant coatings could serve as carriers of antibacterial agents with the primary intention of inhibiting bacterial growth on the implant-tissue interface, while still promoting osseointegration.[1].
- Hydroxyapatite (HAP), natural polymer chitosan (CS), graphene (Gr), and antibiotic gentamicin (Gent) were employed for EPD process, to synthesize improved antibacterial composite coatings [1,2].
- EPD was performed in a single step from multi-component aqueous suspensions.

## EXPERIMENTAL

### Suspension composition:

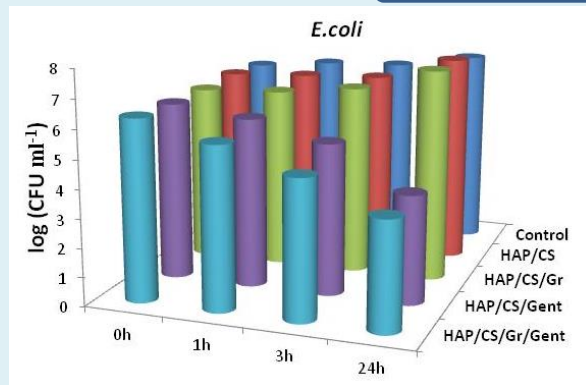
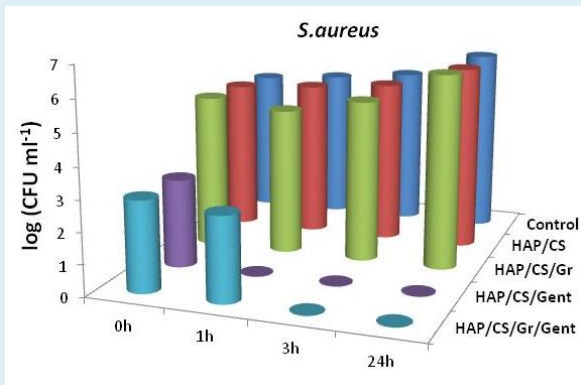
- HAP powder
- Chitosan powder
- Gentamicin sulphate solution
- Graphene flakes

- Ti plate served as a working electrode

### EPD conditions:

- low applied voltage, 5V for 12 min
- from aqueous suspensions

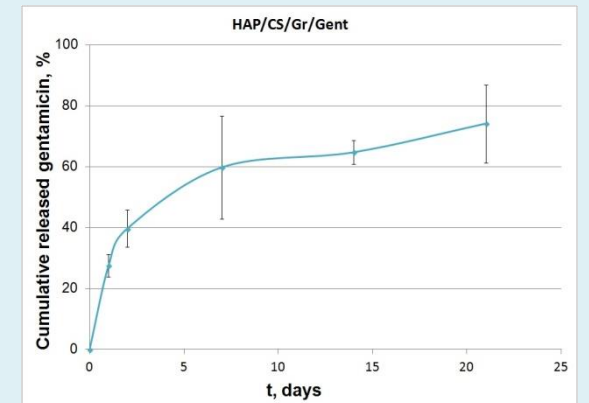
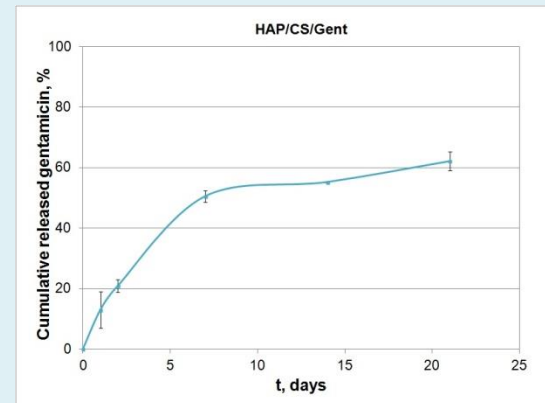
## Antibacterial activity



More pronounced antibacterial effect of HAP/CS/Gent and HAP/CS/Gr/Gent against *S. aureus*, compared to *E. coli*.

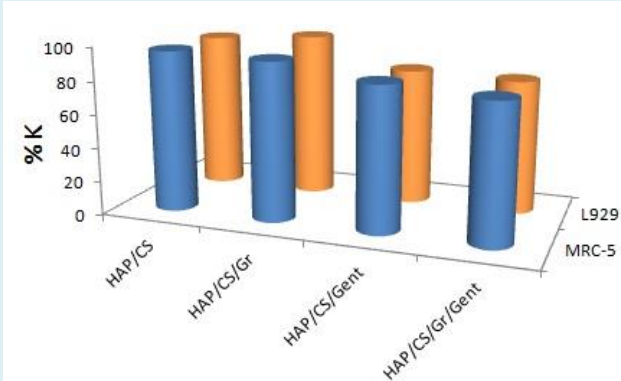
## RESULTS AND DISCUSSION

## Cumulative eluted gentamicin



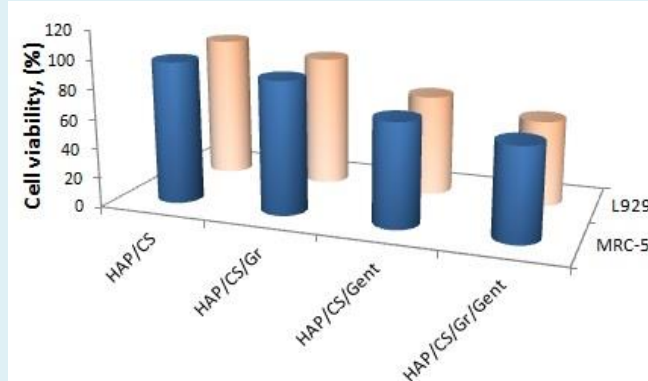
Content of eluted gentamicin was comparable for HAP/CS/Gent and HAP/CS/Gr/Gent coatings, and in both cases burst release of the drug was evident.

## DET test



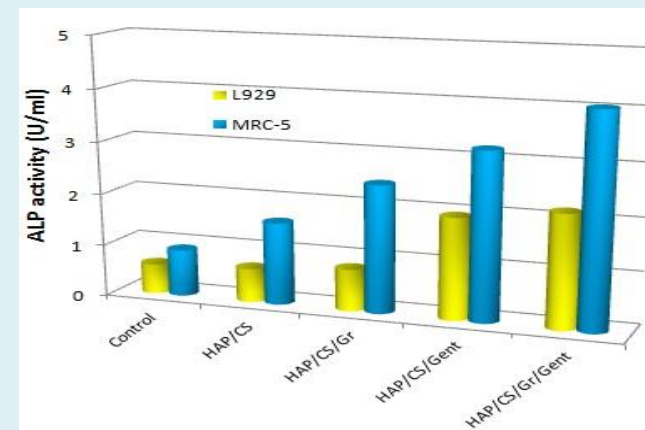
## Cytotoxicity

## MTT test



MTT and DET results confirmed non-cytotoxicity of HAP/CS/Gent and HAP/CS/Gr/Gent coatings towards two different cell lines, fibroblast MRC-5 (human) and L929 (mouse).

## ALP activity



HAP/CS/Gent and HAP/CS/Gr/Gent coatings showed significantly higher ALP activities compared to the positive control, as well as their non drug-eluting counterparts.

## CONCLUSIONS

- The burst effect that is evident for drug release studies coincides well with the *in vitro* antibacterial assay .
- DET and MTT assays indicated low cytotoxicity against MRC-5 and L929 cell lines.
- HAP/CS/Gent and HAP/CS/Gr/Gent exhibited good antibacterial activity against *S. aureus* and *E. coli* indicating their high potential for future use in medical devices.
- ALP assay confirmed the ability of coatings to promote osteoblast differentiation. Osteogenic differentiation highly pronounced in the case of HAP/CS/Gent and HAP/CS/Gr/Gent.

## FUNDING

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## LITERATURE:

- [1] M. Stevanović, M. Đošić, A. Janković, V. Kojić, M. Vukašinović-Sekulić, J. Stojanović, J. Odović, M. Crevar Sakač, K. Y. Rhee, V. Mišković-Stanković, Gentamicin-Loaded Bioactive Hydroxyapatite/Chitosan Composite Coating Electrodeposited on Titanium, *ACS Biomaterials Science & Engineering* 2018 4 (12),3994-4007.
- [2] M. Stevanović, M. Đošić, A. Janković, V. Kojić, M. Vukašinović-Sekulić, J. Stojanović, Jadranka Odović, Milkica Crevar Sakač, Rhee Kyong Yop, Vesna Mišković-Stanković, Antibacterial graphene-based hydroxyapatite/chitosan coating with gentamicin for potential applications in bone tissue engineering, *J. Biomed. Mater. Res. - Part A.* (2020) 1–15.