Chameleon-inspired multifunctional plasmonic nanoplatforms for biosensing applications

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Nano Innovation Conference & exhibition – September 2021/ Roma, Italy

Introduction

Hydrogel

cross-linked polymeric networks, with extensively water swelling capacity, synthesized by simple reaction of one or more monomers

- ✓swelling and retaining a significant fraction of water within their structure, but will not dissolve in water
- ✓mechanical and structural properties similar to many tissues and the ECM
- ✓Biodegradibility and Hydrophilicity
- ✓Ability to be easily tuned to be responsive to an environmental stimulus

Acrylate-based composites Embedded with silver nano-cubes

Inspired from chameleon skin, AgNCs were added to P(NIPAAm-*co*-NIPMAAm) hydrogel

- ✓biocompatible
- ✓ non-toxic
- ✓antibacterial
- ✓Photothermal-responsive
- ✓Great sensing properties

Project Goal

The ultimate goal of this Design is to fabricate a composite of a photothermal responsive platform including P(NIPAAm-co-NIPMAAm) hydrogel embedded with silver nanocubes, layered with an electrospun polymeric mat. Final system have is staeady and flexible, benefiting the properties of both hydrogel and electrospun layer. Silver nanocubes give the antibacterial properties to the platform, while making it fast photothermal responsive and a perfect candidate for glucose sensing.

Preparation of nanostructured platform

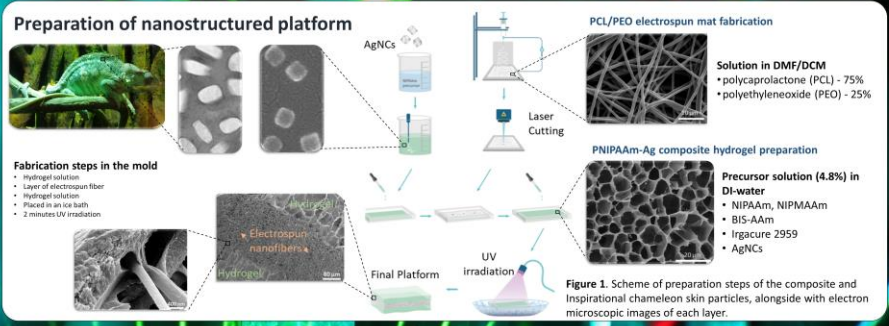

Figure 1. Scheme of preparation steps of the composite and Inspirational chameleon skin particles, alongside with electron microscopic images of each layer.

Mechanical Properties

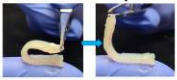

Figure 2. macroscopic images of the platform, showing the ability to flex, twist, bend and be designed in various shapes due to the application.

Antibacterial Properties

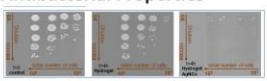

Figure3. The significant difference between the number of remained bacteria on the samples, proves the antibacterial effect of AgNCs.

Photothermal Responsivity

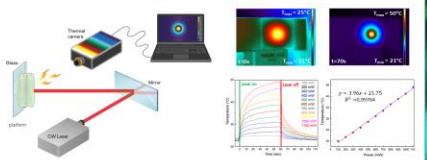

Figure4. Scheme of experiment setup, thermal images and the responsivity curves of the platform in hydrated state showing fast responsivity of the system

Glucose Sensing

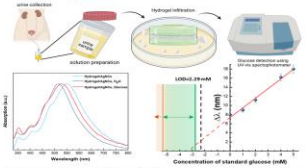

Figure5. Biosensing application of the platfrom, showing the test steps, absorption in different environment and glucose sensing curve, revealing the limit of detection of the system, applicable for both healthy and diabetic ranges.

Conclusions

- ✓Successful fabrication of P(NIPAAm-co-NIPMAAm)/AgNCs composited with PCL/PEO electrospun mat
- ✓Characterization of each layer and the whole platform with structural, morphological, optical, mechanical and antibacterial experiments
- ✓Photothermal responsivity test revealing fast responsivity of the platform and linear correlation between the temperature and the intensity of light
- ✓Glucose sensing tests shows the applicability of the system to be used as a glucose sensor using body fluids

References

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Acknowledgments

This study was partially supported by the First TEAM grant number POIR.04.04.00-00-5ED7/18-00, which is carried out within the framework of the First TEAM program of the Foundation for Polish Science (FNP), co-financed by the European Union under the European Regional Development Fund. The authors are also grateful for the support of this work by the National Agency for Academic Exchange (NAWA) grant no. PPI/APM/2018/1/00045/U/001. Chiara Rinoldi, Paweł Nakielski, and Filippo Pierini acknowledge the financial support from the Polish Ministry of Science and Higher Education through scholarships for outstanding young scientists.

Chiara Rinoldi was partially supported by the Foundation for Polish Science (FNP). Luciano De sio acknowledges the financial support from: Air Force Office of Scientific Research (AFOSR), Air Force Research Laboratory (AFRL) and U.S. Air Force grant number FA9550-18-1-0038 (P.I. L. De Sio, EOARD 2017-2020) and the Materials and Manufacturing; Sapienza University of Rome, under grant no RM11816431206A2C (Progetto di Ateneo 2018, P.I. L. De Sio). Part of this research was also carried out conducted using apparatuses available thanks to EC structural funds within the framework of the Center for Preclinical Research and Technology (CePT), PDIG No. 02.02.00-17-024/08-00.