Italian National Conference on the Physics of Matter

Catania, September 30 – October 4, 2019

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evaluated by flow cytometry, CLSM and western blot assay. These results open the way for the use of poly(allylamine) phosphate nanocarriers for the intracellular delivery of genetic materials.

#116 - HIGHLY TUNABLE PROTEIN MICROSPHERES FOR DRUG DELIVERY

Dirk Fennema Galparsoro - Università degli Studi di Palermo

Other Authors: Vito Foderá, Valeria Vetri

It is well-known that protein amyloid aggregation has profound implications in several neurodegenerative diseases. In contrast, a natural role for amyloid structures as protection, adhesion and storage materials in living system is also reported, promoting protein aggregates as an interesting platform for the design of multifunctional biomaterials. Among the broad range of different amyloid structures protein particulates deserve special attention; they are spherical protein aggregates with radius ranging from hundreds of nm to few um which are readily formed in solution at pHs values near the isoelectric point of the protein they are made of. Interestingly, particulate appears to be a generic aggregation state for globular proteins and they are not related to any disease. Moreover, they can be produced from easily available and low-cost proteins. All this makes these microspheres a good candidate for different applications as biomaterials.
Here we present an experimental study in which particulates are formed from alpha-lactalbumin, a well-known model protein from bovine milk. Microparticles with modified ability of uptaking small molecules or with modified surface layers can be created allowing material functionalization without using complex chemical procedures. Using a combination of bulk spectroscopies and quantitative fluorescence microscopy methods, we highlighted particulates features both at the level of the structure and size as well as their stability and capability to load molecules. These features can be tuned by modifying solution conditions. Our results show how general laws regulating protein macromolecular assembly can be exploited to create a platform for the development of a new generation of biocompatible materials for drug delivery.

#117 - POLYVINYLPYRROLIDONE/HYALURONIC ACID-BASED BILAYER CONSTRUCT: A MULTIFUNCTIONAL WOUND DRESSING

Marco Contardi - Smart Materials Group - Istituto Italiano di Tecnologia (IIT)

Wound healing is a complex succession of biological events divided into 4 phases: hemostasis (0 h after the injury), inflammation (1-3 days), proliferation (4-21 days), and remodeling (21 days – 1 year). Sometimes this process can be interrupted due to bacterial infections or particular physiological states such as diabetes, leading to a chronic and non-healing condition. The management of wound repairing is considered an immense social and financial burden for society and affects the quality of life of over 20 million people worldwide. Therefore, the development of new, inexpensive and intelligent wound dressings that can ensure effective protection and elimination of bacterial colonization of the wound, and at the same time the tissue regeneration is still an imminent needed and a great challenge.
Here, we present the fabrication of a transparent multifunctional bilayer construct for the sequential release of a cutaneous antiseptic and a widely used antibiotic, with anti-inflammatory and regenerative properties potentially suitable for wound healing applications. The polyvinylpyrrolidone/hyaluronic acid-based material was fabricated using a scalable waterborne and eco-friendly solution casting process. The obtained construct showed satisfactory self-adhering strength to human skin and a sustained release of the antibiotic over a period of 5 days. The bilayer resulted in being biocompatible, hemocompatible, and active against *Staphylococcus aureus*, *Escherichia coli,* and *Pseudomonas aeruginosa*. *In vivo* tests demonstrated its capacity to be completely resorbed by the wound, reduce the levels of inflammatory mediators such as TNF-α, IL-6, and IL-1β and accelerate the healing process.