

OR0304

Assembly of vancomycin containing nano-capsules by means of aerosol-assisted atmospheric-pressure plasmaChiara Lo Porto¹, Fabio Palumbo², Pietro Favia³¹Dpt of Chemistry, University of Bari, Bari, Italy ²Institute of Nanotechnology, CNR, Bari, Italy ³Dpt. of Bioscience, University of Bari, Bari, Italy

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We optimized a one-step process to assembly vancomycin-containing nano-capsules for drug delivery applications by means of aerosol-assisted atmospheric-pressure plasma. Nano-capsules are nanometric vesicular systems with a core-shell structure consisting of a cavity and a surrounding polymeric membrane or a coating. A Dielectric Barrier Discharge (DBD) reactor was used: it is very easy to handle and it is suitable for plasma processing thermolabile substrates, as well as for feeding discharges with thermo-degradable biomolecules, due to its very mild operational conditions. This system allows an aerosol of a solution containing a bioactive molecule to be sprayed directly inside the reactor chamber. The droplets of the solvent act as a shield for the dissolved biomolecule, which maintains its structure undamaged in the discharge. The very interesting and unexpected morphology obtained demanded some further investigations. After the immersion in water these spheres become hollow or collapsed upon themselves suggesting a core-shell structure where the core is released in water. A fluorescein solution was sprayed inside the chamber and the coating obtained was observed by means of confocal microscopy; the fluorescence is originated mainly from the spheres therefore it could be hypothesized that the spherical shape derives from the polymerization of the monomer fragments on the surface of the droplets (with structure retaining) in the plasma zone. XPS and FT-IR proved that the Vancomycin drug is present in the coating but not on the surface, more likely inside the spheres. Various discharge parameters and aerosol solutions containing molecules with different molecular weight, ionic groups and polar moieties content were tested and it pointed out that an ionic molecule is necessary to obtain this peculiar morphology and that the discharge parameters can affect the characteristics of the coating obtained.

Keywords

Nano-capsules

DBD

Aerosol

Drug-delivery