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Amphiphilic Coatings Deposited by Catalyst Free PECVD Reactor for Biological Applications

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Drug delivery systems (DDS) are intensively studied and developed for their application in the medical treatment of various diseases. By controlling the drug release around a treatment area over a prolonged period of time it is possible to precisely maintain locally the drug concentration within a therapeutic window and avoid overdoses as well as a sub□therapeutic concentration of the drug. Present research work is devoted to developing plasma methods to deposit functional coatings on collagen membranes by plasma processing to fabricate multi-layered DDS.
Biocompatible collagen membranes were used as substrates. ε□caprolactone and diethylene glycol dimethyl ether were used as precursors to achieve amphiphilic PCL:PEG films. To fabricate DDS, the first layer was a dense barrier layer (200nm) deposited in a low pressure capacitively coupled plasma reactor (13.56 MHz, 25W, 0.5 mbar). The second layer was a carboplatin drug, dried from an aqueous solution on the surface of the barrier layer with a drug load of 200 μg/cm^2. The third layer was a dense barrier layer deposited at the same conditions as the first layer, to form “sandwich” like structure of DDS. The last top layer was deposited in soft plasma condition at atmospheric pressure plasma (18 kHz, 2W, in order to preserve the desired chemical moieties of the precursor). Our challenge is to find an approach to make dense and crosslinked barrier films at atmospheric pressure, to completely replace low pressure systems.
NIH:OVCAR3cancer cell line was used for in vitro measurements of cell interactions with the surface of fabricated DDS. Proposed model of DDS prevents migration, adhesion and growth of cancer cells on its surface, and by tuning the thickness of the dense barrier films it is possible to control drug release kinetics and improve the therapeutic effect. In vivo experiments were carried out where mice lymph nodes were injected with OVCAR3 cells and after development of a tumour DDS membranes were implanted to evaluate the feasibility of the proposed model.

Keywords
drug delivery system
PCL-PEG copolymerization