Salt-assisted compaction for the design of porous albumin scaffolds for the delivery of antitumor drugs

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ABSTRACT

After surgical extraction of solid tumors, the treatment of residual cancer cells is essential to prevent recurrence. Furthermore, the filling of the gap left by the tumor mass requires the use of appropriate biodegradable materials. To tackle these issues, we design a porous material entirely made of albumin for the delivery of doxorubicin, a potent anti-tumor drug. This material is prepared using salt-assisted compaction, which is a patented (European patent application EP3811982) procedure for the preparation of albumin materials in non-denaturing conditions and without the use of toxic crosslinking agents. Solutions of human serum albumin (HSA) and salt (NaBr) are prepared in a sodium acetate buffer (0.2 M, pH 6) and emulsified through intense stirring to obtain homogenous foams. Then, these foams are evaporated at 37°C until the formation of solid materials. After elimination of the salt by washing in water, the obtained materials are entirely made of water-insoluble albumin. These materials are highly porous with interconnected pores. After investigating the effect of the formulation parameters on the formation of these materials and their porosity (pH, salt concentration, and stirring procedure), we show that the pore size of these materials is tunable in a range of 200 to 600 µm according to the tested formulations. After additional characterization, these porous materials are successfully loaded with doxorubicin using a post-loading approach.