Implantable hydrogel design for nanoparticles release useful for glioblastoma treatment

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Glioblastoma multiforme (GBM) is the most common and aggressive tumor of the central nervous system and with a very high risk of recurrence. The current standard care involves resection of the primary tumor mass, followed by radiation and chemotherapy. In the last years, many efforts were made to improve the delivery of anti-glioma drugs to the brain, particularly to bypass blood-brain barrier (BBB) limits. Because of that, we are developing a biomaterial with the following characteristics: biodegradability, biocompatibility, possibility of direct implantation in the brain cavity/tumour and ability to control the release of anti-tumor drugs, free or embedded in nanoparticles. We have prepared a solution 18-20% (w/v) soy isolated protein (SPI) dissolved in PBS useful to generate a stable hydrogel without the need of external crosslinking agents. After jellification (30 minutes at 37° C), we add 2 ml of PBS to each hydrogel to recreate physiological brain environment. Characterizing the biomaterial, we found out that hydrogel gain weight because of swelling (after 1 hour: approx. +20% of weight) and that they undergo hydrolytic degradation (approx. -25% of SPI in 72 hours). To evaluate the capacity of SPI-based hydrogel to entrap and release drug-loaded carriers, BODIPY liposomes have been used as a model. The results showed that in 72 hours the 18% SPI hydrogel released 48, 32% of contained liposomes while the 20% one 56, 15%. Additionally, liposomes loaded with an anti-cancer drug have been trapped in hydrogels to ensure they maintain functionality after release. Released drug carriers where incubated with GBM model cell line and cell viability has been analysed after 24 hours of treatment. At the selected concentration (10 µm of drug), cell viability decreases of about 20% both normal and hydrogel realised liposomes. This stable hydrogel without external crosslinking can find wide applications for in situ release of nanoparticle-based drug delivery systems.