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| ***In-vitro* release of macromolecules from biocompatible hydrogels fabricated for inflammatory biomarker capture and release in periodontal disease diagnostics.** |
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| **Background:** The detection of inflammatory markers in periodontal disease (PD) is essential for diagnosing and managing the condition. Hydrogel scaffolds have been identified as a promising solution for the minimally invasive capture and release of biomarkers due to their biocompatibility, sustained release capacity and suitable porosity. The process of releasing macromolecules from hydrogels designed for inflammatory marker uptake in PD occurs through diffusion, which is influenced by the hydrogel properties and the size of the molecules being released. In PD the targeted macromolecules are typically anti-inflammatory agents, growth factors, epigenetic markers and antibiotics. This work aims to study the *in vitro* release of model macromolecule from hydrogels intended for inflammatory marker uptake and delivery within the periodontal pocket. |
| **Methods:** A total of 42 hydrogel formulations were fabricated by mixing various proportions of Gantrez-S97, Polyethylene glycol, and Polyvinyl alcohol with water as dispersion medium. The aqueous blends were dried and thermally crosslinked to produced samples for characterisation. The swelling kinetics of the formulations at different pH, temperature and swelling medium was investigated by measuring the percentage increase in weight at various time points. The texture of the formulations was investigated my measuring the force required to break the formulations. Based on the results from the swelling and texture profiles, three formulations were selected for model macromolecule (FITC-dextran) release studies.  The FITC-dextran loaded hydrogels (approximate weight 16mg) were immersed in an elution system containing 10mL of tris buffered saline (TBS) pH 7.6 for 24 hours. The release medium was kept at room temperature with constant agitation (50 rpm) and at fixed intervals, 1 mL aliquots were collected and replaced with fresh TBS. The fluorescence intensity of the drug released was measured at an excitation and emission wavelength of 490 and 520 nm. The result is presented as cumulative drug release (mg/mL) over time. |
| **Results:** On the basis of swelling properties at different temperature, pH, and swelling media, in addition to texture analysis profile of samples, formulations F1, F3, and F20 were selected for module compound loading and release. Formulations with percentage increase in weight in weight ≤150 at the 24 h swelling time point were eliminated. Additionally, samples that had their physical structural integrity compromised at the onset of the texture analysis were also excluded. The cumulative macromolecule release of F1 ,F3, and F20 during the first 4 hours were 0.1012 ± 0.0069, 0.1784 ± 0.0161, and 0.0209 ± 0.0146 mg/mL respectively (n=4 ± SD). The release pattern was similar to the swelling profiles of the hydrogels in different under the various swelling conditions. |
| **Conclusions:** In this study, the selection criteria for hydrogel formulations for module compound release has been established based on swelling profiles and texture analysis. Hydrogels exhibited burst release of module compound followed by a sustained release over 24 h. Therefore, the three formulations could be promising prototypes to capture and release relevant biomarkers in PD diagnosis. |