Supplementary Material

Preparation and Antimicrobial Properties of Alginate and Serum Albumin/Glutaraldehyde Hydrogels Impregnated with Silver(I) Ions

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Optimisation of the electrochemical experimental parameters

Cyclic voltammetry was first performed on a standard $AgNO_3$ solution (4.5×10^{-4} M) to obtain electrochemical profiles for the Ag^+/Ag^0 redox couple, in a cell assembly comprising a glassy carbon working electrode, platinum wire auxiliary electrode and a saturated calomel reference electrode in an aqueous $NaNO_3$ supporting electrolyte solution (0.2 M) (Fig. A1). The working electrode potential was swept between 0.60 and -0.10 V at a scan rate of 0.02 V s^{-1}. Reduction of Ag^+ to Ag^0 occurred at Epc = 0.205 V leading to deposition of Ag^0 on the electrode surface. The corresponding oxidation stripping process was observed as a well-defined peak at Epa = 0.396 V (Fig. A2). At potentials more negative than 0.205 V the deposition process is diffusion limited. Thus, a reduction potential from this diffusion limited region, i.e. 0.04 V, was chosen for all subsequent silver deposition experiments involving linear sweep voltammetry (LSV). In order to deposit low concentrations of silver, longer deposition times were employed, while at higher silver concentrations the deposition times required were shorter. Thus,

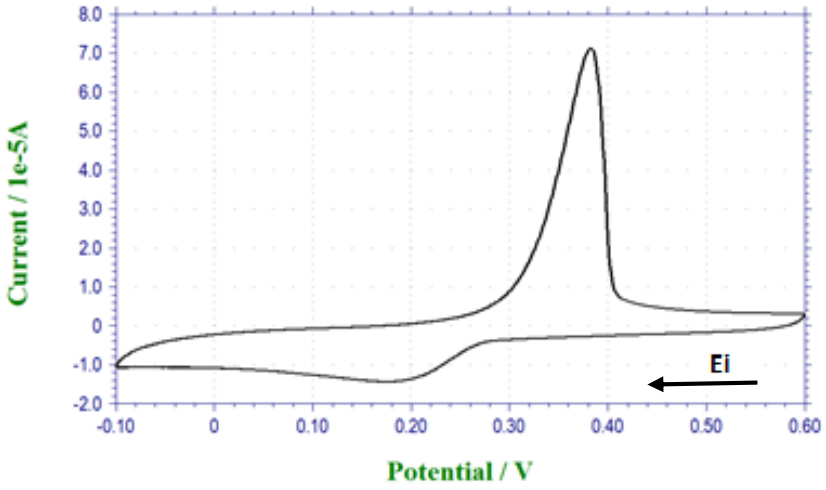

Figure S1: Typical cyclic voltammogram recorded from a solution of 5×10^{-4} M $AgNO_3$ in 0.2 M $NaNO_3$ at a glassy carbon electrode. Scan rate, 100 mV s^{-1}. Directional arrow indicates the initial applied potential, Ei.

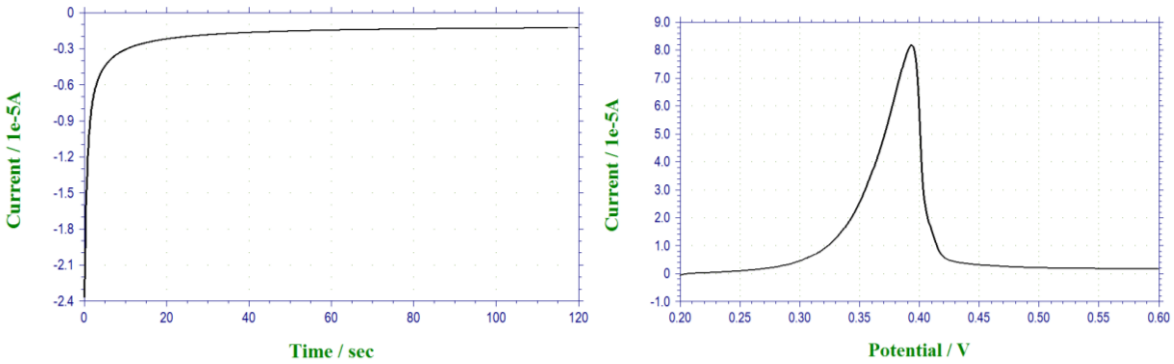

Figure S2: Typical Anodic stripping voltammetry profiles obtained from a solution of 5×10^{-4} M $AgNO_3$ in 0.2 M $NaNO_3$ for (**left**) 120 s deposition time at a constant applied potential of 0.04 V and (**right**) the corresponding linear sweep voltammetry stripping profile obtained at a scan rate of 20 mV s^{-1}.

Stripping peak currents (for generation of calibration curves and leaching experiments) were normalised with respect to the experimental deposition times. Silver metal was stripped from the electrode surface using LSV, swept over the potential range of 0.2 to 1.0 V. A constant potential of 0.9 V was applied for 1 min to ensure that any remaining surface bound silver was re-oxidised from the electrode and returned to the solution. Following each run, the working electrode was removed, washed with deionised water and then polished with 0.05 µm alumina paste before the next measurement was recorded. Using this methodology, stripping peak currents were obtained from $AgNO_3$ solutions over the concentration range, 1 x 10^{-3} to 1 x 10^{-6} M. Calibration curves correlating stripping peak current to Ag^+ ion concentration were constructed using a range of $AgNO_3$ standard solutions (Fig. A3).

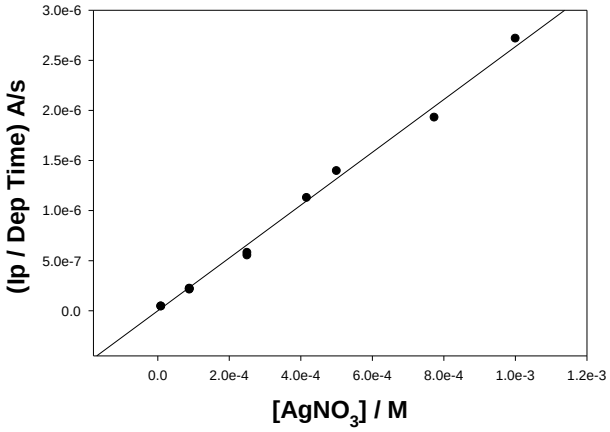

Figure S3: Typical calibration curve obtained from solutions of $AgNO_3$ in 0.2 M $NaNO_3$, generated using anodic stripping voltammetry at a glassy carbon electrode. Data from the linear sweep voltammetry peak currents at a scan rate of 20 mV s^{-1}, deposition time 60 s and deposition potential 0.04 V. Peak currents were normalised with respect to deposition times. The peak current – deposition time normalisation procedure was validated for a range of deposition times, from 30 s to 900 s.

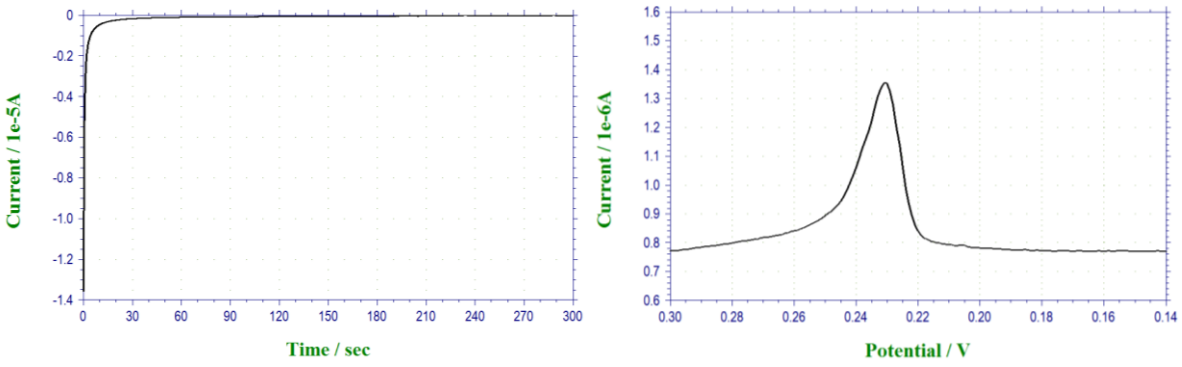

Figure A4: Typical anodic stripping voltammetry profiles to monitor Ag^+ leaching from BSA/GLA/Ag^+ hydrogel disks. Constant potential deposition **(right)** of leached silver ions was performed at 0.04 V for 300 s and the subsequent linear sweep voltammetry stripping peak current **(left)**, corresponding to 0.98±0.04 µM Ag^+, was obtained at a scan rate of 20 mV s^{-1}.

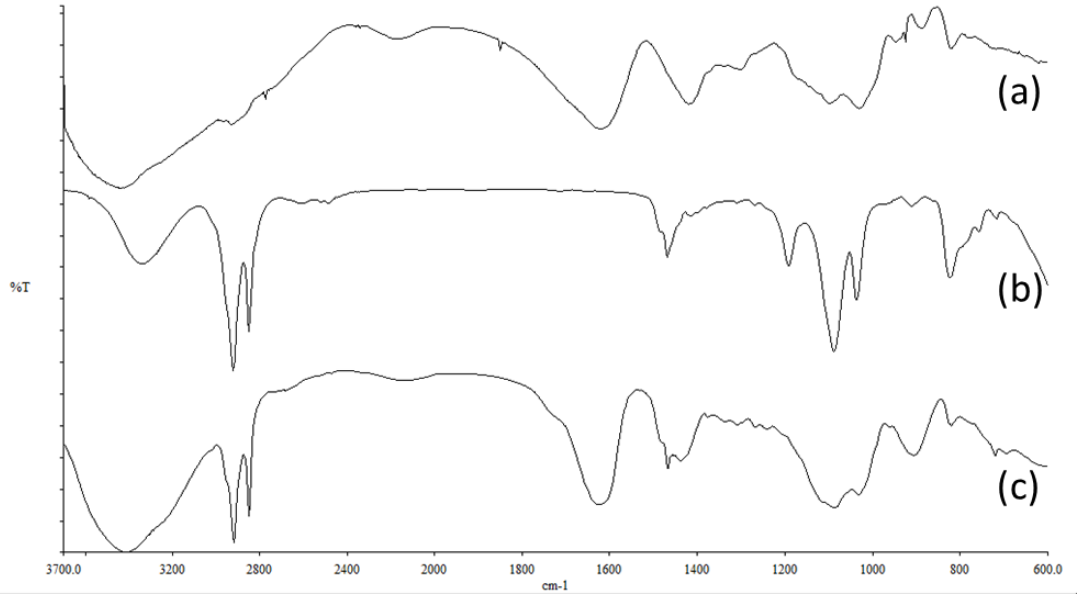

Figure S5. FTIR recorded of (a) sodium alginate (b) (3-(trimethoxysilyl)propyl)-octadecyldimethylammonium chloride c) CaALG/QA

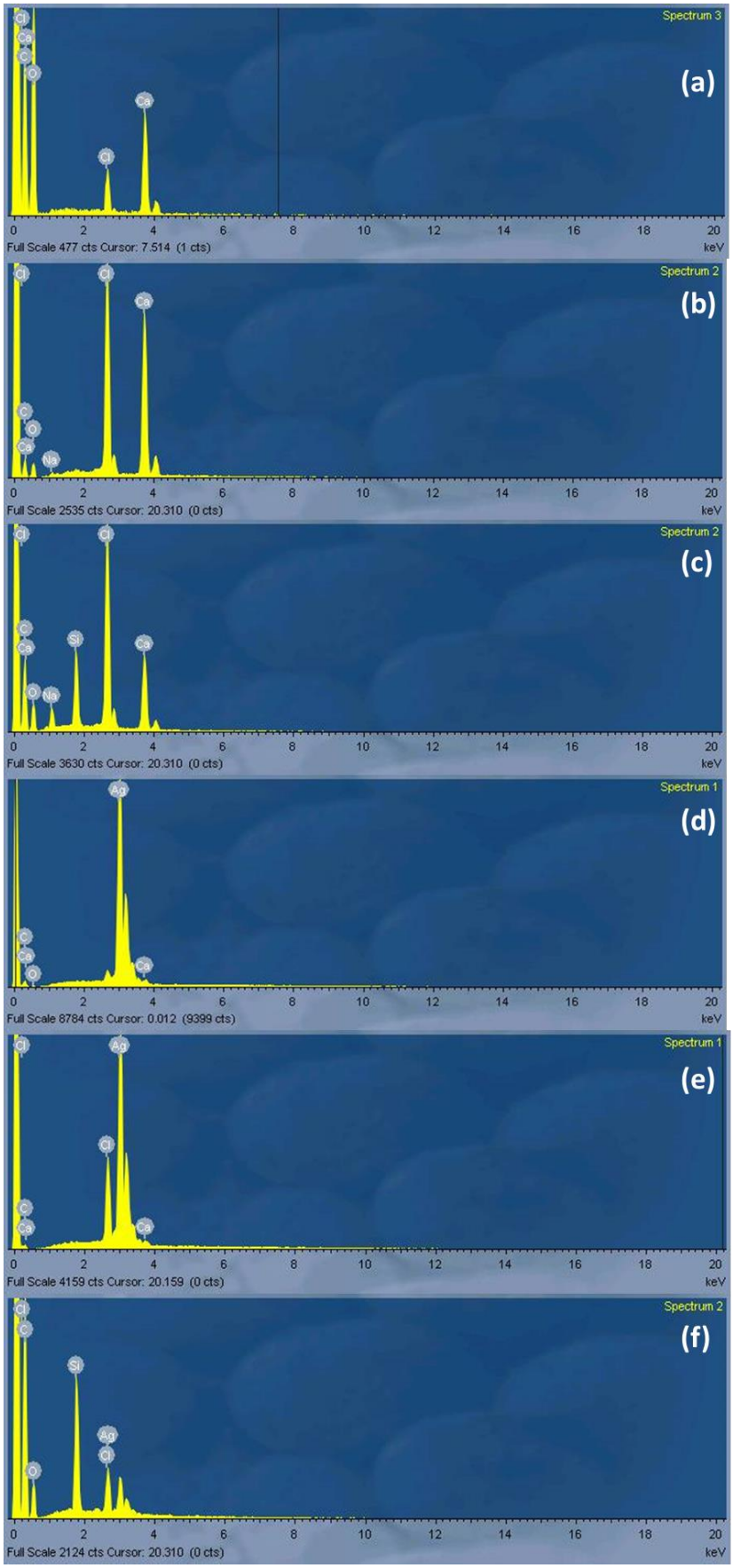

Figure S6: EDX Spectra of the alginate beads (a) CaALG, (b) CaALG/PGA/HSA, (c) CaALG/QA, (d) CaALG/Ag^{+}(0.1), (e) CaALG/PGA/HSA/Ag^{+}(0.1), (f) CaALG/QA/Ag^{+}(0.1)