

Abstract

Novel Composite Polyaniline-Based Materials For Fluoxetine Monitoring And Calcium Release

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The synthesis and characterization of novel polyaniline based hydrogel polymer films were investigated in this work. The highest hydration level achieved for these novel electroactive hydrogels was $119 \pm 2.7\%$ per gram of dry hydrogel. The lowest resistance measured using a two-point method with a probe separation of one centimetre for hydrogels placed on an insulation surface was $0.95 \text{ M}\Omega$. UV-vis data confirmed the polyaniline produced within these membranes was the conductive emeraldine form of the polymer.

Two application areas of these novel polymers were explored. A potentiostatically electrosynthesized polyaniline-based cytochrome P450 2D6 biosensor (PAn-CYP2D6) was developed that was capable of detection of fluoxetine, a powerful selective serotonin reuptake inhibitor used in the treatment of depressive disorders. The study found that fluoxetine is a substrate for this enzyme at low fluoxetine concentrations (0.4 mM fluoxetine / 1.0 pM CYP2D6) but inhibits CYP2D6 above this concentration. Under this application area an electroactive hydrogel, cytochrome P450 2D6 biosensor was also evaluated. This sensor showed similar responses to the non-hydrogel based sensor.

The second area of application investigated was the use of these composite electroactive polymers as matrices for controlled drug delivery. The composite electroactive polymer network was prepared by incorporating the electroactive polymer, polyaniline, into a poly-(2-hydroxyethyl methacrylate), poly(HEMA), matrix. The hydrogel matrix included *N*-[tris(hydroxymethyl)methyl] acrylamide, poly(ethyleneglycol)(400)monomethacrylate, tetraethylene glycol diacrylate as the crosslinker, the photoinitiator 2,2-dimethoxy-2-phenylacetophenone with ethylene glycol and deionized water as solvents. It was a proof-of-principle study for the release of the divalent cation, Ca^{2+} , from these electroconductive hydrogels. A novel bifunctional monomer, 3-(1-ethyl methacryloate) aniline, was prepared to effect the covalent linkage of the polyaniline polymer and the poly(HEMA) hydrogel. The study was limited to the release of entrapped calcium ions loaded into the hydrogel at the time of formulation and fabrication. These studies were carried out under passive and single applied potential conditions. It was found that the release of Ca^{2+} ions from these composite films under electrostimulated conditions was less by a factor of 2.6 when compared to the unstimulated conditions.

Keywords: Ann M. Wilson, biosensor, cytochrome P450_{2D6}, CYP 2D6, divalent cations, electroactive release, hydrogel, electroconductive hydrogel, fluoxetine, polyaniline.