

## ESI

### **Galvanic coupling conducting polymers to biodegradable Mg initiates autonomously powered drug release**

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#### **Converting molar concentration into dose amounts**

The molar concentration of released Dexamethasone was converted into dose amounts ( $\mu\text{g cm}^{-2}$ ) using the following equations:

From the calibration curve the concentration of Dex is determined. Using the concentration and volume of the aliquot sample the number of mols of Dex was calculated (Equation 1).

$$\frac{[\text{Dex}]_{\text{calibration}}}{\text{Vol}_{\text{sample}}^{\text{litre}}} = \text{mol}_{\text{Dex}} \quad (1)$$

The mass of Dex is then calculated using the number of mols of Dex from Equation 1 and the molecular weight of Dex (Equation 2).

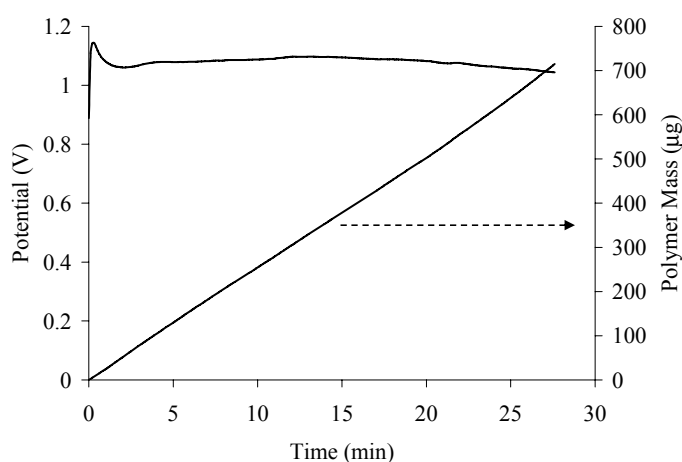
$$\text{mass}_{\text{Dex}} = \text{molar mass}_{\text{Dex}} \times \text{mol}_{\text{Dex}} \quad (2)$$

The dose amount was calculated using Equation 3 and is derived from the fact that the area of polymer exposed to the PBS solution is  $1.0 \text{ cm}^2$ .

$$\mu\text{gcm}^{-2} = \frac{\left(\frac{\text{mass}_{\text{Dex}}}{1 \times 10^{-6}}\right)}{\text{surfacearea}_{\text{PPy.Dex}}} \quad (3)$$

#### **QCM and calculating the percentage release of incorporated Dex**

The QCM data recorded during the polymer growth is shown in Figure 1.



**Figure 1.** Mass change and polymerisation potential recorded during the electrochemical polymerisation of PPy.Dex.

Assuming a doping ratio of 1:4 (Dex:pyrrole units in a tetramer oligomer repeat unit)<sup>1</sup> the mass of incorporated Dex and percent release of Dex was calculated using the following equations;

$$DexMass_{polymer} = \left( \frac{MolarMass_{Dex}}{MolarMass_{oligomer}} \right) \times PolymerMass_{QCM} \quad (4)$$

$$\% Release = \frac{DexMass_{released}}{DexMass_{polymer}} \quad (5)$$

Where,

- $DexMass_{polymer}$  is the mass of Dex in the polymer,
- $MolarMass_{Dex}$  is the molar mass of Dex ( $516 \text{ g mol}^{-1}$ ),
- $MolarMass_{oligomer}$  is the molar mass of the tetramer oligomer ( $780 \text{ g mol}^{-1}$ ),
- $PolymerMass_{QCM}$  is the mass of deposited polymer measured by QCM, and
- $DexMass_{released}$  is the mass of Dex released measured by UV-vis and applying equations 1 and 2,

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1. Y. H. Lee, J. Y. Lee, D. S. Lee, Synth. Met. 2000, 114, 347-353.