Supplementary material to

Transport of silver nanoparticles from nanocomposite Ag/alginate hydrogels under conditions mimicking tissue implantation

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Optical microscopy of alginate discs

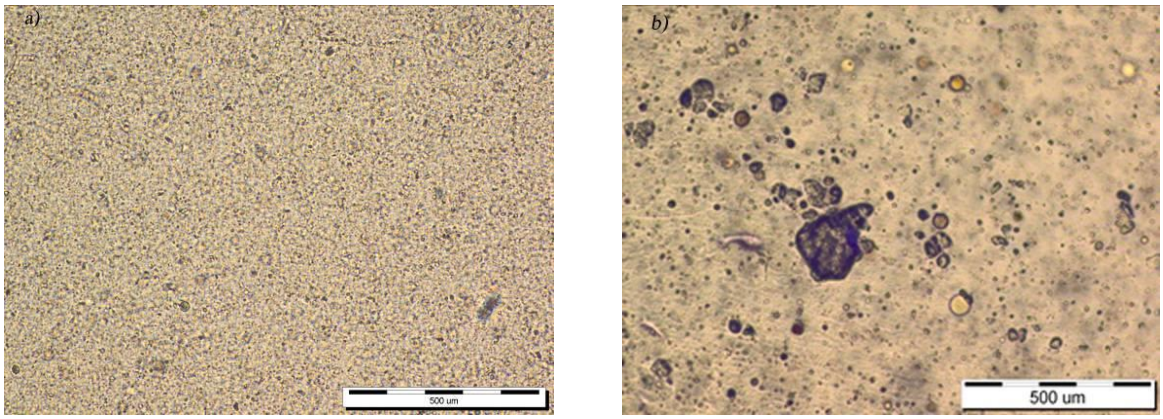

Figure 1S. Optical microscopy of: a) initial alginate disc, b) alginate disc after 14 days staying under Ag/alginate disc. Both discs were washed in distilled water before taking photographs.

Derivation of the equation describing the silver accumulation rate in water under static conditions (Eq. 2)

The rate of silver accumulation in surrounding water is equal to the silver release rate across the boundary:

$$V_m \frac{dc_m}{dt} = -AD_n \left(\frac{\partial c}{\partial r} \right)_{r=R} \quad (1)$$

where c_m is the total silver concentration in water, V_m is the water volume (10 cm^3), R is the microbead radius, D_n is the diffusion coefficient of AgNPs within a microbead and A is the total surface area of all microbeads that can be calculated as:

$$A = 4N\pi R^2 \quad (2)$$

where N is the number of all microbeads in the experiment. The volume of all microbeads (V) can be expressed as:

$$V = N\frac{4}{3}\pi R^3 \quad (3)$$

Now, using the equations (2) and (3) the area of microbeads could be expressed in terms of the volume of microbeads as:

$$A = \frac{3V}{R} \quad (4)$$

Thus, the silver accumulation rate in water can be expressed now as:

$$\frac{dc_m}{dt} = -\frac{3V}{RV_m} D_n \left(\frac{\partial c_n}{\partial r} \right)_{r=R} \quad (5)$$

Application of the internal diffusion model on the experimental results under perfusion

Diffusion of a substance from a sphere is described by the Fick's second law of diffusion, which is solved for the initial release times ($n/n_0 < 0.4$) in the form:

$$\frac{n}{n_0} = 6\left(\frac{Dt}{\pi R^2}\right)^{0.5} \quad (6)$$

where n is the amount of the substance released at the time t, n_0 is the total amount of substance that can be released from the sphere, D is the diffusion coefficient of the substance in the sphere, and R is the radius of the sphere. Application of the Eq. (6) to the experimental results of silver release from packed beds of Ag/alginate microbeads under continuous perfusion is presented in Figure 2S. It is clear that the internal diffusion model cannot describe silver release under these experimental conditions.

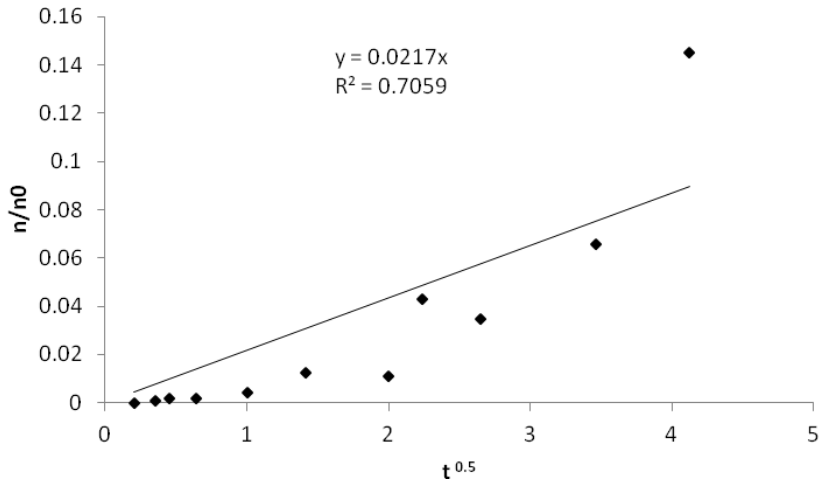

Figure 2S. Application of the internal diffusion model to the experimental results of released silver from packed bed of Ag/alginate microbeads during water perfusion.