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MODELING AND QUANTIFYING DRUG RELEASE KINETICS

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Drug release profiles from various formulations (spheres, composite spheres, and slabs) are calculated: *i)* numerically, using Monte Carlo simulations and *ii)* analytically, through the solution of diffusion equation. Diffusion-controlled release is considered. The obtained release profiles are described and quantified through the stretched exponential function (known also as Weibull function), Eq. (1) [1,2].

$$\frac{M_t}{M_\infty} = 1 - \exp[-(t/\tau)^b] \qquad (1)$$

In Eq. (1), M_t is the amount of drug released at time t, M_∞ is the total amount of drug released at infinite time, and b,τ are the two stretched exponential parameters. We investigate the dependence of these parameters on the device characteristics [3,4,5].
Equation (1) has the advantage over other popular descriptions, like the Higuchi [6] or Peppas [7,8] models, that it exhibits the proper asymptotic behavior of the release at relatively long times. Such a qualitatively appropriate description of the whole release profile is achieved without introducing more parameters than for example the well known and extensively used power-law model.

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References:

[1] K. Kosmidis, P. Argyrakis and P. Macheras, *Pharm. Res.* ***20*** (2003) 988.
[2] V. Papadopoulou, K. Kosmidis, M. Vlachou and P. Macheras, *Int. J. Pharm.* ***309*** (2006) 44.
[3] A. Hadjitheodorou and G. Kalosakas, *Mater. Sci. Eng. C* ***33*** (2013) 763.
[4] A. Hadjitheodorou and G. Kalosakas, *Mater. Sci. Eng. C* ***42*** (2014) 681.
[5] G. Kalosakas and D. Martini, *Int. J. Pharm.* ***496*** (2015) 291.
[6] T. Higuchi, *J. Pharm. Sci.* ***50*** (1961) 874.
[7] N.A. Peppas, *Pharm. Acta Helv.* ***60*** (1985) 110.
[8] P.L. Ritger and N.A. Peppas, *J. Control. Release* ***5*** (1987) 23; *ibid* ***5*** (1987) 37.