Wischke, C.; Schneider, C.; Neffe, A.T.; Lendlein, A.:

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In: Journal of Controlled Release (2013) Elsevier

DOI: 10.1016/j.jconrel.2013.08.052

Sustained release hydrogels by *in situ* polymerized polyalkylcyanoacrylate coating

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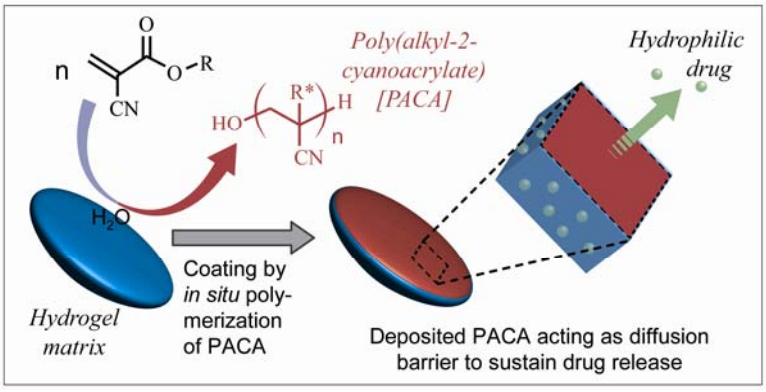
Polymeric hydrogels are ideal carriers for sensitive hydrophilic bioactive molecules such as proteins, but have also been extensively explored for small molecule drugs. However, due to their high water content and the diffusivity of hydrophilic drugs, a rapid release over a few hours is a common observation for such systems [1]. A prolonged drug release may be possible by establishing physical interactions or covalent bonds between the drug and the hydrogel matrix [2], but this requires a specific design of the matrix polymer possibly limiting its applicability only to a single drug. Therefore, alternative, more widely employable approaches are of interest for sustained release *via* hydrogels.

In this study, alginate was selected as hydrogel matrix (30 $mg \cdot ml^{-1}$), filled into a mold, and physically crosslinked with calcium ions to films in the absence or presence of diclofenac sodium (10 $mg \cdot ml^{-1}$) as a hydrophilic model drug. In order to reduce the release rates, a polymeric coating of the hydrogel matrix should be established as a rate limiting diffusion barrier. The employed strategy involved an *in situ* anionic polymerization of poly(alkyl-2-cyanoacrylate) [PACA] exclusively initiated on the hydrogel surface with subsequent PACA deposition. It was further postulated that the diffusion-driven drug release may be controlled by the type of side chain of PACA. A series of PACAs with increasing side chain hydrophobicities was employed and the structure of the coating was characterized by contact angle measurement, optical profilometry, scanning electron microscopy, and atomic force microscopy (AFM). The lowest sample roughness (Rq = 9 nm of a 5x5 μm^2 AFM scan), i.e., the most homogeneous coating was detected for poly(*n*-butyl-2-cyanoacrylate) [PBCA]. At the same time, a substantially sustained drug release from the PBCA coated hydrogel was detected. Overall, *in situ* polymerized PACA coatings of hydrogels may be a general strategy to sustain drug release and, since selectively initiated by water at the hydrogel surface, may also be applicable to more complex shaped hydrogel carriers from various matrix polymers.



Scheme 1: Scheme of hydrogel coating by PACA serving as a diffusion barrier to sustain drug release.

Key Words: coated hydrogel, poly(alkyl-2-cyanoacrylate), *in situ* polymerization, diclofenac, alginate

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