ISGC 2022

N°1099 / PC
TOPIC(s) : Polymers or composites / Alternative technologies

Polyelectrolytes as a platform for drug depots

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PURPOSE OF THE ABSTRACT

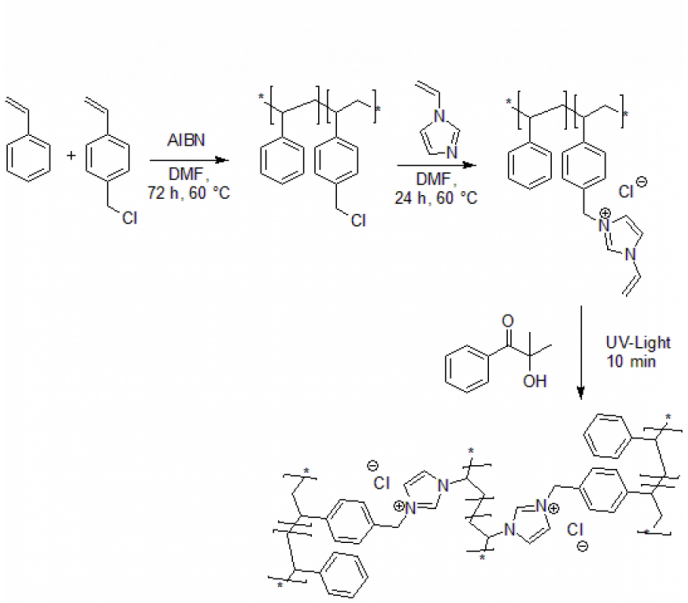
Polyelectrolytes are a widely used class of polymers. They can be used as ion exchange membranes, as hydrogels or as drug carrier system among many other applications. They consist of a polycation or a polyanion backbone and the related counterion.
Herein, we present the synthesis of polyelectrolytes used both for electrospinning as well as for the production of hydrogels. Both systems are investigated as drug depots.

Electrospinning is a special technique to produce fibers with a diameter of a few nanometers or micrometers out of polymer solutions. The application of electrospun fibers for drug delivery is of great interest. One advantage is a large surface area to volume ratio. Another advantage is that the fibers have the same size and a structure similar to cells, allowing cells to interact with these systems better than with other systems. The use of synthetic polyelectrolytes in electrospinning for drug delivery has not been described in the literature yet.

Hydrogels on the other hand are crosslinked polymers, which are swellable in water without dissolving in it. They can incorporate high amounts of water into their three-dimensional space. They are usually non-toxic and have a good biocompatibility. Hydrogels can also be used as a drug release system.

The release of drugs out of depots can happen with different mechanisms. One possibility is the use of biodegradable polymers. Another possibility is the release via diffusion. With the use of polyelectrolytes the release process can also be influenced via ionic interaction.
In this work we focused on the synthesis of different polyelectrolytes based on styrene and 4-vinylbenzyl chloride and the preparation of different drug depots out of them. A common strategy in the prepation of polymer networks is the polymerization of monomers together with a crosslinker. However, we polymerized the styrene and 4-vinylbenzyl chloride first to get co-polymers with an exact molecular weight and an exact monomer ratio. In the second step we functionalized these polymers with different amine groups and then finally crosslinked them in the third step. This strategy allows for a more flexible polyelectrolyte design as well as the study of structure-property-relationships.

FIGURES



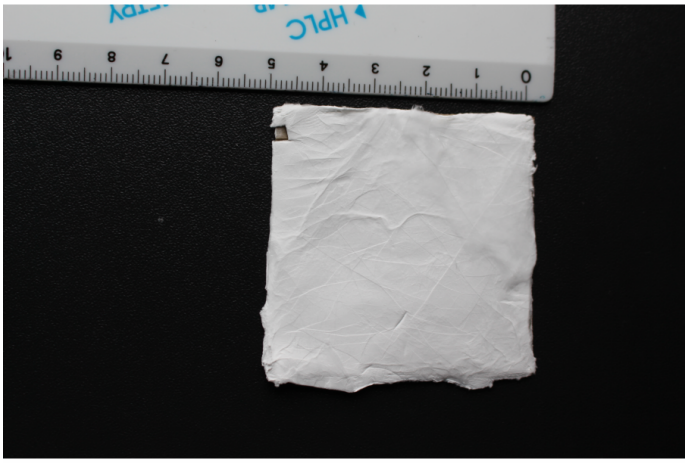


FIGURE 1
Reaction scheme

This figure shows the synthesis of the polymer system.

FIGURE 2
Electrospun fiber mat

This figure shows an example of the electrospun fibers

KEYWORDS
polyelectrolytes | electrospinning | hydrogels | drug delivery

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