Dual drug release of triamterene and aminophylline from Poly(N-isopropylacrylamide) hydrogels studied by UV-Vis, ESEM and DLS

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An alternative to conventional dosage of antineoplastic agents is controlled and localized release from a polymer. A large variety of drugs could be released in a localized manner, alone or combined, from hydrogels. Recently, combination therapy have shown to be an effective way to treat diseases and regenerate tissues. In order to optimize these effects, different drugs have to be employed in the optimal dose and the adequate periods of action on damaged tissue.

We used temperature-sensitive Poly(N-isopropylacrylamide) hydrogels as drug delivery systems, so changes in body temperature induced by pathogens can act like external stimulus to activate controlled release of the drug incorporated in the hydrogel.

In the combined release studies, we chose two model drugs: aminiphilline and triamterene. Triamterene (2,4,7-triamino-6-fenilpteridina) is an antidiuretic used with success in combination with diuretics in the treatment of hypertension and edema. Aminophylline is a bronchodilator used successfully in the treatment of asthma in combination with other drugs.

We found no interaction between drug and polymer (linear dependence between the amount of drug loaded and the PNIPAM concentration). The ammount of drug released was measured by UV-Vis spectroscopy following the evolution of the absorption peaks of aminophylline (271 nm) and triamterene (365 nm). The maximum release time is greater for triamterene (days) than for aminophylline (hours). By changing the shape of the hydrogel (from a disk of 1 cm to a cylinder of 10 cm of thickness), and with increasing molecular weight or solubility of the drug, we observed that the diffusion coefficient decreases. On the contrary, with increasing hydrophobicity of the drug diffusion coefficient increases.

The evolution of pore size distribution of hydrogels during loading and release was obtained by dynamic light scattering (DLS) and the algorithm NNLS. When loading and releasing the drug, pore size of the hydrogel decreases and increases again without reaching the initial pore size of hydrogel, respectively. We observed that the greater the concentration of drug loaded in the hydrogel greater the reduction in pore size.

References

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Figures

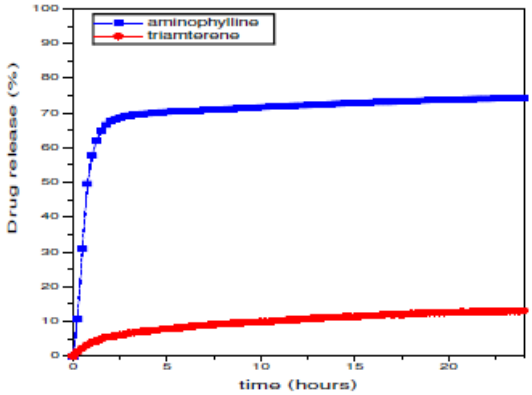

Figure 1. Release percent of triamterene and aminophylline from PNIPAM hydrogels in distilled water at 37 ºC.

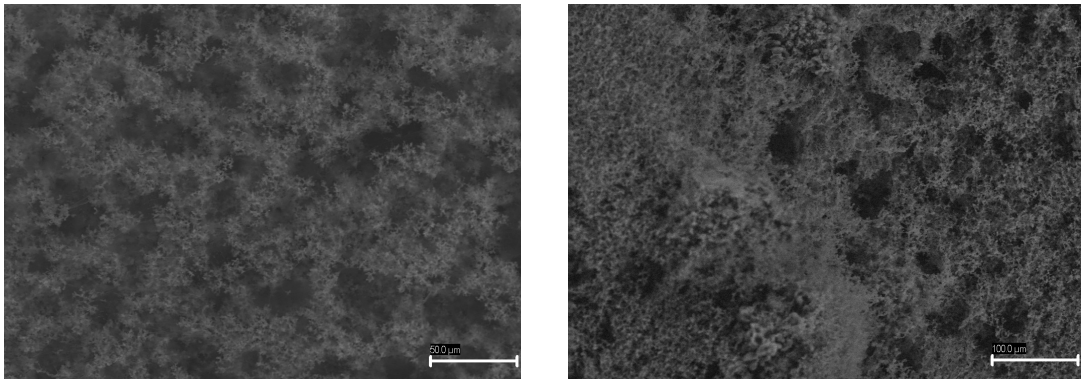

Figure 2. ESEM micrograph showing the change in pore size with the release of the drugs from the hydrogels.