Binding of cisplatin to poly(acrylic acid)

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The ability of smart polymers to respond to external stimuli causes an interest for their application in anticancer drug delivery and targeting. A pH -responsive smart polymer, poly(acrylic acid), PAA, has been formulated as a carrier for anticancer drugs. When exposed to changes in pH PAA undergoes a reversible change in its chemical nature forming poly(sodium acrylate) (PNaA). pH-responsive drug delivery systems are relevant for anticancer research as tumors have a more acidic environment than non-cancer cells.¹

In the present work, cisplatin was bound to linear PAA² by simple mixing in aqueous solution, pure water or phosphate buffer. The binding was monitored online and offline for the first time using capillary electrophoresis in the critical conditions (CE-CC). CE-CC is a novel method that separates natural and synthetic (co)polymers according to their microstructure, purity and/or composition rather than their molecular weight.³

The online monitoring in CE-CC enabled separation of the drug and PNaA during their binding. A decrease in the electrophoretic mobility of PNaA was observed over time which suggests the binding of the polymer to cisplatin (Figure 1). Confirmation is sought by solid-state ¹⁹⁵Pt NMR spectroscopy.

The dispersity of the electrophoretic mobilities of PNaA bound to cisplatin increases during the binding. This indicates an increase in the heterogeneity of the polymer during the reaction in water and phosphate buffer. The binding in phosphate buffer and water leads to different chemical structures of the PNaA bound to cisplatin with a similar UV absorbance but different electrophoretic mobilities.

The drug release from PNaA was also monitored using CE-CC and an increase in the PNaA’s electrophoretic mobility was observed.

The information on the binding process via CE-CC enables optimization in terms of drug loading for effective targeting and delivery.