ABSTRACT (EN)

The first part of this dissertation thesis investigates the possibilities of analysis and characterization of liposomes using capillary electrophoresis. Our primary objectives were to identify suitable background electrolytes and optimize experimental conditions to minimize liposome adsorption onto the capillary wall. To overcome the limitations of the UV detection method, we incorporated fluorescently labeled phosphatidylcholine into our liposomal formulation which allowed us to distinguish between fluorescently labeled liposomes and other compounds. By utilizing laser-induced fluorescence detection, we proved that liposome adsorption onto the capillary wall was occurring.

The second part is focused on the dynamic and permanent coating of the capillary wall to overcome problems with liposome adsorption. Several dynamic coating approaches were tested for four different polymer coating agents and evaluated based on the suppression of the electroosmotic flow and the coating stability. Linear polyacrylamide was used for permanent coating and its performance was compared with the tested dynamic coatings. This part utilized capillary electrophoresis with laser-induced fluorescence detection to enhance the sensitivity and specificity of liposome detection.

Lastly, liposomes were used as a pseudostationary phase in liposomal electrokinetic chromatography for monitoring drug-lipid interactions. We focused on how varying liposome concentration in the background electrolyte affects the separation kinetics. The presence of liposomes altered the electrophoretic mobility, peak shapes, or both, of several active pharmaceutical ingredients. For instance, uncharged canagliflozin migrated out of the neutral zone in the presence of liposomes and its electrophoretic mobility linearly increased with increasing liposome concentration. Additionally, we used liposomes mimicking natural membrane compositions, prepared from bovine liver or heart tissue extracts. We observed that the interactions also differentiate based on lipid composition with liver extract-based liposomes exhibiting on average stronger effect on the migration of active ingredients. We then examined the effects of temperature and pH on these interactions for nine lipophilic drugs. Increased temperature enhanced the effective mobility of most drugs due to the lower background electrolyte viscosity and increased lipid bilayer fluidity. However, the effect of pH was inconclusive as both, liposome presence and pH changes, influenced drug behavior making the data analysis very complex. Our findings highlight the importance of considering liposome composition, temperature, and pH when studying API-liposome interactions.