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Direct Quantification of Unencapsulated Doxorubicin in Liposomal Doxorubicin Formulations Using Capillary Electrophoresis

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ABSTRACT: To understand the quality, efficacy, and safety of liposomal drugs, it is necessary to develop a robust and accurate method for the separation and the quantification of unencapsulated and liposome-associated drugs (or liposomal encapsulated drugs). Conventional methods involve separation of unencapsulated and liposome-associated drug using solid phase extraction and further drug quantification. This is a lengthy process, and sometimes solid phase extraction induces drug leakage from the liposomes causing erroneous results. In this study, a capillary electrophoresis (CE) with UV-Vis detection method was developed for the simultaneous separation and quantification of unencapsulated drug from liposome-associated drug using a doxorubicin-containing liposome formulation as the model drug. CE separates the unencapsulated drug and liposomal drugs based on their electrophoretic mobility under the electric field. Liposomal drugs were diluted to the appropriate concentrations with running buffer or 5% dextrose before hydrodynamic sample injection. Using a high-sensitivity detection cell, the doxorubicin detection sensitivity was enhanced about 10-fold compared to the conventional on-column UV-Vis detection with a 75 µm i.d. capillary column.. The optimal separation of unencapsulated doxorubicin from liposome-associated doxorubicin with minimal perturbation of liposomes was accomplished using phosphate buffer (20 mM, pH 6.5) in the presence of 10 % sucrose.

Keywords: Doxorubicin, Liposome, Unencapsulated drugs, Encapsulated drugs, Capillary electrophoresis

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