Quantification of lysophosphatidylcholines in Parenteral Liposomal Formulations by Liquid Chromatography – Mass Spectroscopy (LC-MS)

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Identification and quantification of impurities in the liposomal formulation is important as they may impact the safety and efficacy of the drug. Cholesterol and phospholipids are major excipients in liposomes and they may be vulnerable to oxidation and hydrolysis reactions. Regarding phospholipids, the major degradation pathway is hydrolysis because saturated phospholipids in commercial liposomal drugs has less potential for lipid oxidation. Lysophosphatidylcholines (LPCs) are the major degradation products that can be formed through the hydrolysis of phospholipids within the manufacturing or long-term storage of liposomal formulations. Herein, we reported a simple, fast and sensitive method that can be utilized for the quantitation of LPCs in liposomal formulations. The liposome drugs were solubilized by direct dilution using chloroform:methanol (1:1) solvent and then further diluted with mobile phase to appropriate concentrations for liquid chromatography – mass spectroscopy (LCMS) analysis. The LPCs was separated from other components in the liposomal formulations by C18 stationary phase and quantified with accurate mass Q-TOF mass spectrometry. This method was validated according to USP compendial procedures and has been applied to analysis of five commercial parenteral liposomal drug products. The limit of quantitation (LOQ) was determined as 10.0 ng/mL which provides higher sensitivity with more than 95% accuracy. The linearity range was 5-400 ng/mL. This method has the advantage of high specificity, short running time, smaller sample size required for analysis, and others compared to some existing LPCs analysis method.

In conclusion, this LC-MS method can be utilized to quantify LPCs in the liposomal formulations with reasonable linearity, specificity, accuracy, and precision.