

Title : Evaluation of Lipid Peroxidation of Liposomes and Cooking Oils in Various Conditions

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ABSTRACT

Lipid peroxidation is a major oxidative degradation process affecting lipid-rich systems such as liposomes and cooking oils, leading to reduced stability and functionality. Therefore, reliable evaluation of lipid oxidative stability is crucial. This study aimed to evaluate lipid peroxidation in liposomes and cooking oils under various conditions using the thiobarbituric acid reactive substances (TBARS) assay, which measures malondialdehyde (MDA) as an indicator of lipid peroxidation. In this study, liposomes composed of soy phosphatidylcholine (SoyPC) and cholesterol at different molar ratios were prepared and subjected to varying storage durations, NaCl supplementation, and freeze-thaw treatments, and stability was assessed using the TBARS assay together with particle size, zeta potential, and polydispersity index (PDI). Cooking oils, including soybean oil and lard, were analyzed under storage conditions, air exposure, and heat treatment. The results demonstrated that lipid composition and preparation conditions significantly influenced oxidative stability in liposomes, and liposomes with different SoyPC:cholesterol ratios showed increased MDA production over time. The SoyPC:cholesterol (10:1) liposomes exhibited the greatest susceptibility to oxidation during prolonged storage but had the highest physical stability, based on its zeta potential. Freeze-thaw treatment increased MDA formation, indicating reduced membrane stability. In cooking oils, lard exhibited higher MDA levels than soybean oil during storage, whereas air exposure reduced MDA levels, possibly due to the loss of volatile oxidation products, and heat treatment induced greater lipid peroxidation in soybean oil due to its higher polyunsaturated fatty acid content. Overall, these findings underscore the necessity of optimizing lipid composition and storage environments to minimize oxidative damage. This study provides a foundational for improving the shelf-life of pharmaceutical liposomal formulations and enhancing the quality control of cooking oils in the food industry.

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