Liposomes in core/shell nanofibers as a novel water retention system to preserve enzymatic activity

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Abstract

Liposomes are promising drug carriers. Their broader application to drug delivery systems is hampered because of their short half life and inefficient retention at the site of application. These disadvantages could be significantly reduced in combination with nanofibers. Different nanofiber-liposome systems are produced: liposomes adhered to classically prepared nanofibers, liposomes co-electrospun with nanofibers, and core/shell nanofibers with embedded liposomes. Each of these three subtypes has the potential for biomedical application. Herein, we demonstrate that liposomes adhere well and remain tightly secured to the nanofibers. In contrast, co-electrospinning does not conserve intact liposomes. However, intact liposomes incorporated into nanofibers by coaxial electrospinning show the greatest promise. We report polyvinyl alcohol (PVA)-core/poly-ε-caprolactone (PCL)-shell nanofibers with embedded liposomes and show that they preserve the enzymatic activity of encapsulated horseradish peroxidase (HRP). Proteins in liposomes are well protected against high-intensity electric fields during nanofiber fabrication, which results in the preservation of enzymatic activity. In addition, dry nanofibers with encapsulated liposomes are also characterized by high and long-lasting water retention, which reflects the fact that encapsulated substances are well protected from the environment.