Preparation of Self-Assembled Colloidal Microcapsules by Using Solid Lipid Nanoparticles

Gökçe Dicle Kalaycıoğlu, Nihal Aydoğan*

Hacettepe University, Department of Chemical Engineering, 06800, Beytepe, Ankara, Turkey

*anihal@hacettepe.edu.tr

Solid lipid nanoparticles (SLN) have been used as an alternative nanocarrier since the 1990s, which can be prepared by using various physiologically related lipids, emulsifiers and water [1]. Due to their high biocompatibility, stability and availability, to encapsulate various active materials, SLNs are distinguished from other alternatives in the use of pharmaceutics and biomedical applications. In addition to their use in several areas including, more versatile systems can be established via self-assembly of SLNs. These self-assembled structures, independently of their single form, possess attractive properties such as high stability, enhanced functionality and increased loading capacity. Colloidal microcapsules are one of the most interested part of these self-assembled structures whose shell side are composed of nanoparticles [2].

In this study, it is aimed to prepare novel colloidal microcapsules as an alternative drug delivery agent by using SLNs as the constituent of shell side. Aminated positively charged PS particles were used as core material. Within the context of this study, anionic SLNs and cationic gold nanoparticles (AuNPs) were synthesized by using “Microemulsion Method” and “Seed-Mediated Method”, respectively. These nanoparticles were absorbed onto the surface of PS particles by using “Layer-by-Layer technique (LbL)”. Incubation time and amount of nanoparticles were optimized and absorption steps were monitored by tracking the change of zeta-potential. Moreover, Scanning Electron Microscopy images of coated PS particles were taken to observe the degree of surface coverage. It is presented in the Figure 1. after the optimization, SLNs on the surface can be seen clearly which indicates the accomplishment of the coverage of surface and supported the zeta-potential values. Drug encapsulation and release studies have been performed by using several drugs such as dexamethasone, ibuprofen etc. after core removal. As such, a versatile diagnotherapy agent has been successfully prepared which carries therapeutic ingredients and can be used as a biosensor by the virtue of AuNPs.

Figure 1. SEM images of A) bare PS particle, B) 4 layer absorption onto the PS particles, C) SLNs on the surfaces
