A novel treatment tool for PLA-based encapsulation systems

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Active compounds encapsulation in polymeric carriers is a technology widely used as it protects and improves the physical characteristics of the active compound and controls its delivery. The effectiveness of polymeric microcapsules (MCs) depends on the barrier properties of the polymeric shell; for a given polymer the latter properties are affected by its molecular weight (MW) and crystallinity (x_c). The aim of this study was to modify the MW and x_c of the MC shells *via* solid state polymerization (SSP). SSP might take place in the amorphous regions of the polymer *upon* heating at temperatures higher than the glass transition point (T_g), but lower than the onset of melting (T_m). Poly(lactic acid) (PLA) was chosen as the polymeric carrier and coumarin 6 as the encapsulated compound. PLA is a biobased and biodegradable polymer widely used in drug loading systems, and coumarin 6 is a fluorescent hydrophobic drug that can be used as model compound.

SSP effectiveness as a post-encapsulation tool was proven for blank PLA MCs of two molecular weights (MW= 50000 g mol^{-1} and 20000 g mol^{-1}). SSP led to a 40-50% enhancement of the weight-average molecular weight of the polymeric shell and to an enhancement, from 40 % to up to 70 %, of the mass fraction crystallinity in the case of the low MW-MCs. In an attempt to transfer the gained knowledge to the encapsulation systems, coumarin 6 loaded MCs were prepared. The average size of the MCs was measured at 502nm with a polydispersity index of 1.6 while the encapsulation efficiency was found 15 % for a drug loading of 10 %. UV-Vis measurements show that the compound was fully released after 10 days. Coumarin 6 is found to be thermally stable at temperatures used for SSP, while the study of SSP application in the case of loaded MCs is in progress.

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