Photothermally triggered phase transition in drug delivery liposomes

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The light-to-heat conversion in liposomal drug delivery systems can be obtained by adding a photothermal agent (i.e. substance that converts light energy into heat) into the cavity of the liposomes. Heat is transported to the lipid bilayer that goes through a phase transition [1]. This phase transition is then incorporated with drug release [2]. In this work, two photothermal agents, gold nanorods (GNRs) and indocyanine green (ICG), have been studied in a model drug delivery system with fluorescent thermometers, laurdan and CdSe quantum dots (QDs). Both photothermal agents are shown to convert light into heat in an extent to cause a phase transition in the surrounding lipid bilayer. The phase transition itself is proven with laurdan generalized polarization (GP) [3]. We also show that the model drug (calcein) is released from the liposomes due to the photothermally triggered phase transition (see Fig. 1).

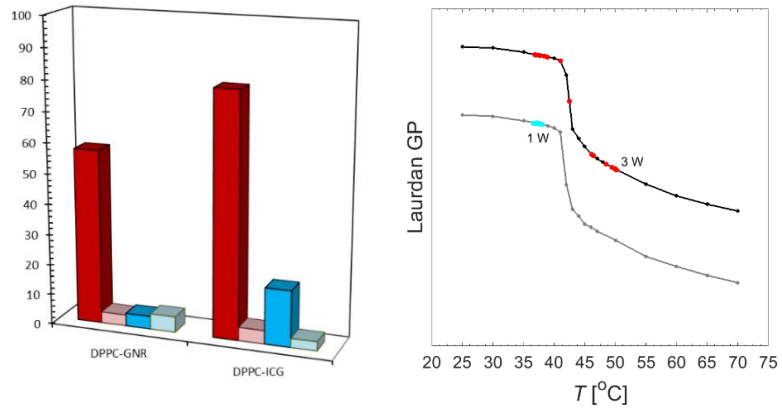

Figure 1. Left, the amount of released calcein after 15 min of illumination. The left columns represent the system with GNRs and right ones are systems with ICG. The left-most of the columns is the illumination of photothermal solution with 3 W; next, control sample with 3 W; illumination of photothermal solution with 1 W, and finally, control with 1 W. Right, laurdan generalized polarization as a function of temperature. The temperature increases with 1 W and 3 W illumination are shown with blue and red respectively.

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