http://dx.doi.org/10.1016/j.pdpdt.2017.01.052

Oral OC-047

Polymeric self-assemblies for photodynamic therapy: A critical approach

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The work presented here suggests a new approach in the critical development of polymeric nanovectors for photodynamic therapy (PDT) against cancer. Whereas hundreds of studies quickly jump forward from formation of self-assemblies to biological application without having a thorough examination of the vector solution, we suggest having a parallel assessment of formation/characterization of the nanovectors and biological activity [1]. This is possible by first using a careful physical chemistry characterization of the vectors by both batch techniques (light and neutron scattering, electron microscopy, atomic force microscopy) and Asymmetrical Flow Field-Flow Fractionation (AsFlFFF) coupled to adequate detectors (refractometry, light scattering) [2]. This enables us to fully characterize the vectors regarding purity, size and zeta potential.

Data on both polymeric micelles and polymersomes are presented here, using poly(ethyleneoxide-b-ε-caprolactone), poly(ethyleneoxide-b-D,L-lactide) and poly(ethyleneoxide-b-styrene). Self-assemblies exhibiting size range of 20–200 nm are presented and reveal the possible presence of different populations of nanovectors in some cases. Controlled mixtures of different nano-objects are also studied, as well as crosslinked systems. For each new vector, its ability to carry a photosensitizer (Pheophorbide a) for PDT is examined. The activity in PDT either in 2D and 3D cell culture is presented and compared on different batches, in link with the purity analysis. The work shows that selected mixtures of different vectors with different morphologies or sizes may lead to synergetic effects. Also, a strong influence of the crosslinking of the vector has been observed and will be presented.