Nanocomposites and nanomaterials

Heterogeneous polymeric nanoparticles for phototheranostics

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Nanotechnology provides unique opportunities for addressing many of pitfalls in the diagnosis and therapy of various diseases. It has the potential for advancing the field of medical imaging with multimodal nanoparticular probes and can also offer nanoplatforms for targeted drug delivery to the diseased tissues. With the nanotechnology-enabled combination of diagnostics (imaging) and therapeutic capabilities, a term “theranostics” is coined to tag an emerging paradigm for a modern personalized medicine. Imaging guided polymeric nanovehicles for drug delivery are among the most intensively developed subjects in the medical application of nanotechnology. The advantages of polymeric over other types of nanomaterials are based on the flexibility over which their structures can be modified to yield nanomaterials of high heterogeneity [1].

The ability to penetrate a tissue is a key to applications of light to diagnostics (e.g., optical imaging) and therapy (e.g., photodynamic therapy, PDT). The “optical transparency window” for tissue is known to exist in the near-infrared (NIR) range. This talk will present our work on development of NIR traceable heterogeneous polymeric nanoparticles for a conventional and X-ray induced PDT. We assess nanoparticles of different morphology (core, core-shell or shell with hollow core), size (~20-200 nm) and composition [polystyrene (PS), polyacrylamide (PAA), poly-N-isopropylacrylamide (PNIPAM)]. The photoactive agents within nanoparticles embrace small molecules that work as light absorbers, excitation energy mediators, imaging agents, photosensitizers for PDT. The talk will conclude with a discussion on challenges in design and synthesis of nanoparticular agents for NIR imaging guided phototherapy.

1. *Elsabahy M., Heo G. S., Lim S.-M., Sun G., Wooley K. L.* Polymeric nanostructures for imaging and therapy // Chem.Rev.-2015.-**115.-**P. 10967−11011.