Tuneable Nanobiomaterials for Cancer Treatment

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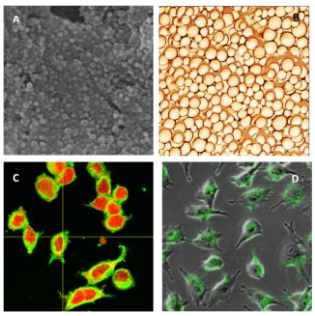
The present contribution describes the synthesis and characterization of custom-made biodegradable and biocompatible polyurethanes (PURs) and their application as nanoparticle (nps)-forming materials for cancer treatment. PURs possess high chemical versatility and can be prepared from a wide range of starting reagents, allowing the tuning of their physical, mechanical and biological properties according to the desired application. Moreover, introduction of bioactive molecules as building blocks or as pendant groups can be achieved by simple chemical reactions [1]. This versatile chemical structure, characterized by alternated soft and hard segments, can be exploited to prepare a wide range on nano-sized systems for both, active and passive, cancer targeting, as well as for theranostic applications.

Novel approaches to the preparation of tailor-made PUR nps for targeted cancer therapy will be described. Tuning of PUR hydrophilic/hydrophobic balance through a proper selection of the macrodiols resulted in the modulation of nps properties, such as extent of cellular internalization, size, drug cytotoxicity, drug release and coating by serum proteins. Moreover pendant amino-functionalities were introduced and exploited for the covalent coupling of the monoclonal antibody (mAb) Herceptin (HER) obtaining good selectivity in *in vitro* cell models. Theranostic PUR nps were also prepared by co-encapsulating the anticancer drug Paclitaxel (PX) and SPIONs, obtaining a 4-fold higher contrast efficiency, compared to free SPIONs. Our group has demonstrated that PURs hold a number of advantages over traditionally used polyesters and are promising candidates for cancer nanomedicine.

Fig.1 Morphology of PUR nps assessed by A) SEM and B) AFM microscopy. Cellular internalization of nps (green fluorescence) by C) breast and D) human mesothelioma cancer cells



References

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