Polydopamine nanoparticles-based hyperthermal chemotherapy for the treatment of liver cancer

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Polydopamine (PDA) is a polymer synthesized by the self-polymerization of dopamine monomers; during the polymerization process, spherical nanoparticles are obtained (PDA NPs) [1], the characteristics of which can be easily tuned by tailoring the synthesis parameters: in particular, size can be altered by changing the ammonia/dopamine molar ratio [2]. PDA NPs have been attracted the interest of researchers because of their interesting properties; in particular, they own high drug encapsulation capacity, easy and versatile surface modification through their catechol, imine, and amine groups, and ability to convert the near-infrared (NIR) radiation into heat, as well as strong antioxidant capacity [3]. In our study, considering their mentioned excellent properties, PDA NPs have been proposed to be exploited as anti-cancers agent *via* hyperthermia through remote NIR excitation. In order to let them acquire a stronger cancer therapeutic activity, PDA NPs have been loaded with a chemotherapeutic agent, sorafenib (SFR-PDA NPs), specifically effective on liver cancer. Representative scanning electron microscopy (SEM) and transmission electron microscopy (TEM) images are reported in Figures 1A-D, and show highly uniform and spherical nanoparticles. The excellent colloidal stability of the nanovectors, evaluated through ζ-potential assessment (Figure 1E), has been demonstrated by values of -46.7 ± 0.3 mV (PDA NPs) and -33.5 ± 0.7 mV (SRF-PDA NPs). Eventually, considering the data obtained after irradiation (performed for 10 min) with a single-mode NIR laser (808 nm), a consistent temperature increment from 37°C to 54°C was observed (Figure 1F). Altogether, these results encourage further *in vitro* investigations on liver cancer models in order to arrive closer to their clinical applications.

References

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Figure

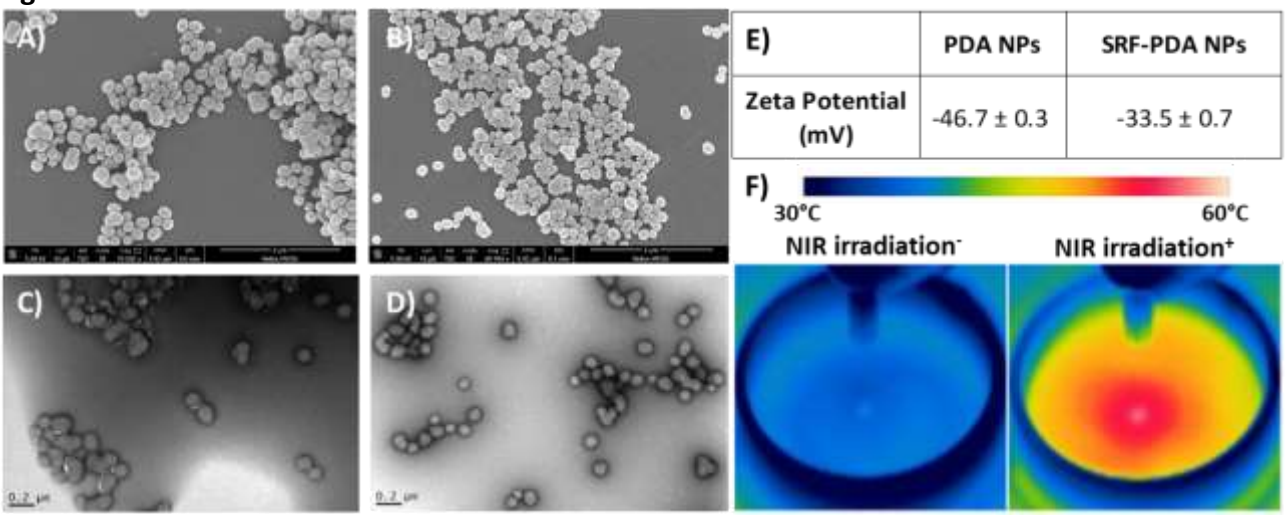

Figure 1: Characterization of PDA and PDA-SRF NPs. Representative scanning electron microscopy (SEM) and transmission electron microscopy (TEM) images of PDA (**A** and **C**) and PDA-SRF NPs (**B** and **D**). ζ-potential measurements (**E**) and thermo-images of an aqueous dispersion of NIR-stimulated PDA NPs **(F).**