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Samarium oxide as a radiotracer to evaluate the in vivo biodistribution of PLGA nanoparticles

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Abstract

Developing nanoparticulate delivery systems that will allow easy movement and localization of a drug to the target tissue and provide more controlled release of the drug in vivo is a challenge in nanomedicine. The aim of this study was to evaluate the biodistribution of poly(D,L-lactide-co-glycolide) (PLGA) nanoparticles containing samarium-153 oxide ([(sup153)Sm]Sm(sub2)O(sub3)) in vivo to prove that orally administered nanoparticles alter the biodistribution of a drug. These were then activated in a nuclear reactor to produce radioactive (sup153)Sm-loaded-PLGA nanoparticles. The nanoparticles were characterized for size, zeta potential, and morphology. The nanoparticles were orally and intravenously (IV) administered to rats in order to trace their uptake through imaging and biodistribution studies. The 153Sm-loaded-PLGA nanoparticles had an average size of 281 ± 6.3 nm and a PDI average of 0.22. The zeta potential ranged between 5 and 20 mV. The [(sup153)Sm]Sm(sub2)O(sub3) loaded PLGA nanoparticles, orally administered were distributed to most organs at low levels, indicating that there was absorption of nanoparticles. While the IV injected [(sup153)Sm]Sm(sub2)O(sub3)-loaded PLGA nanoparticles exhibited the highest localization of nanoparticles in the spleen (8.63 %ID/g) and liver (3.07 %ID/g), confirming that nanoparticles are rapidly removed from the blood by the RES, leading to rapid uptake in the liver and spleen. From the biodistribution data obtained, it is clear that polymeric nanoscale delivery systems would be suitable for improving permeability and thus the bioavailability of therapeutic compounds.