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DEVELOPMENT OF FUNCTIONALIZED RESINS FOR THE PURIFICATION OF INNOVATIVE RADIOPHARMACEUTICALS

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Summary: Vector-driven internal radiotherapy is a rapidly growing field that completes the conventional techniques for cancer treatment such as surgery, chemotherapy or external radiotherapy. The appropriate radionuclide is coupled with a specific vector (monoclonal antibody, peptide...) in order to deliver the radioactivity specifically to the tumor cells. Contrary to the other methods, radioimmunotherapy allows the treatment of diffuse or metastatic tumors, limiting damage on the healthy tissues. Recent developments in isotope production now provide access to novel radionuclides and open new opportunities for theranostics. However, the production of novel radiopharmaceuticals is often limited by a short half-life (few days), high specific activities (> GBq/g) and high levels of isotopic purity required (> 99.9 %). Therefore, reliable and efficient separation and purification processes are needed. Solid phase extraction processes are an attractive solution for the purification of radionuclides, as they allow using simple, compact equipment, with obvious advantages for radioprotection and handling. Moreover, this type of processes produces less waste and effluents compared to solvent-type extraction and are largely operated using remote control.

An isotope of ruthenium has been selected for the development of a new radiopharmaceutical, in agreement with several criteria established by physicians, radiochemists, and nuclear engineers. Ruthenium can be produced from an irradiated metallic target. After dissolution of the irradiated material in nitric acid, ruthenium can be extracted and purified by solid phase extraction using a series of organic resins, either commercially available or specifically developed for this application. Results concerning the performance of the various resins in surrogate solutions will be presented and discussed. The present studies pave the way to the development of a novel ruthenium separation processes and contribute to a better understanding of the factors influencing the extraction properties of ruthenium isotopes.