New method to prepare diagnostic medical radioisotope

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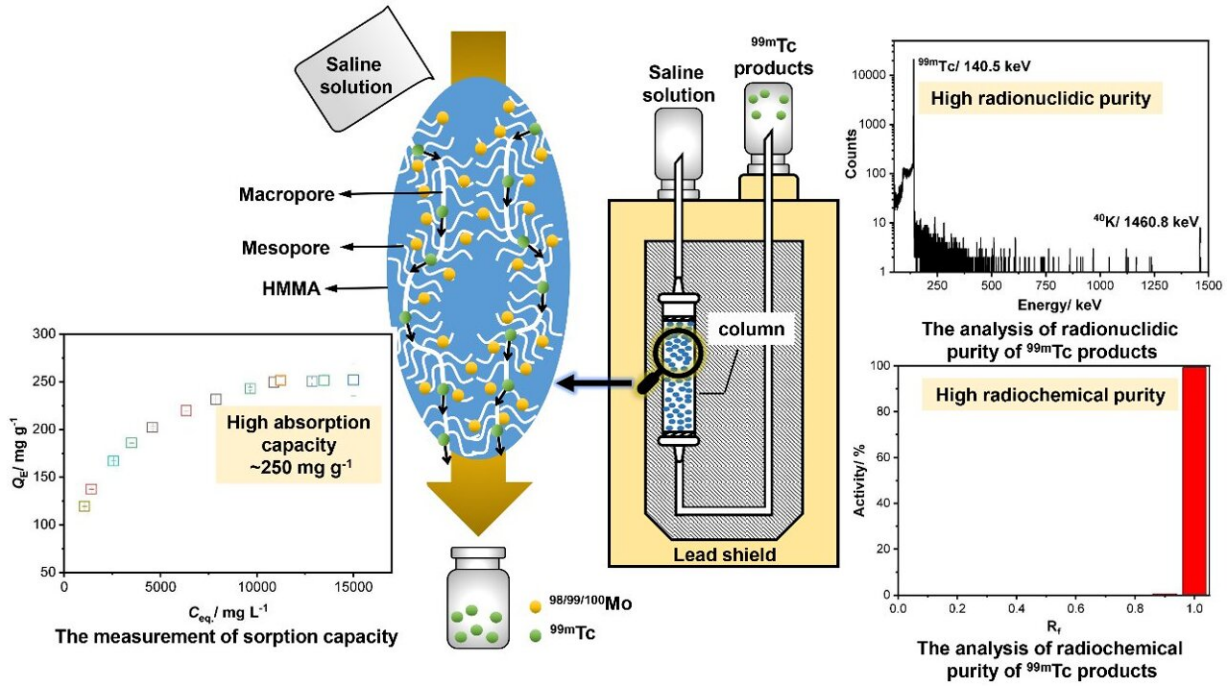

The investigation on preparation of LSA ^{99}Mo/^{99m}Tc generator. Credit: WANG Jieru and QIN Zhi

Researchers at the Institute of Modern Physics (IMP) of the Chinese Academy of Sciences (CAS) have conducted a study on preparation of low specific activity (LSA) ^{99}Mo/^{99m}Tc generator, which has potential application prospect for the accelerator/reactor-based production of the

medical isotope ^{99}Mo.

^{99m}Tc, produced from the decay of its parent radioisotope ^{99}Mo, is the most commonly used diagnostic medical radioisotope, comprising 80 percent of all diagnostic radionuclides. Annual worldwide demand for ^{99}Mo is estimated to be approximately 500 thousand Ci, which provides diagnoses for about 30 million people. However, in China, the clinical ^{99}Mo/^{99m}Tc generators are totally dependent on imports at present.

Currently, the production of ^{99}Mo (a high specific activity of 10^4 Ci g^{-1}) is mainly generated from (n, f) reaction in reactor using highly enriched uranium-235 target. Nevertheless, most of nuclear reactors are confronted with many issues, such as security, technique, overhauling, which cannot satisfy with the growing demand for ^{99}Mo. Besides, the route of ^{99}Mo separation is complex and a great amount of high-level radioactive waste liquid is produced during the process, increasing the probability of nuclear proliferation risk.

To make sure a reliable supply of ^{99}Mo, accelerator/reactor-based production of ^{99}Mo has been explored all over the world. Thus, it is of great importance to develop LSA ^{99}Mo/^{99m}Tc generators using the column absorbents which has high absorption capacity for Mo ions, and achieve recycling of enriched Mo target.

The researchers from the Nuclear Chemistry Group of IMP have carried out an investigation on the synthesis of hierarchically macro/mesoporous γ-Al_2O_3 (HMMA), which is applied in the preparation of LSA ^{99}Mo/^{99m}Tc generator.

Compared with the ordinary alumina (2–20 mg Mo per g of alumina), which is used for fission ^{99}Mo/^{99m}Tc generator, HMMA exhibited high capacity to Mo ions with about 250 mg Mo per g of HMMA.

Furthermore, a LSA ^{99}Mo generator prepared using HMMA as column

matrix is capable of fine recovery of ^{99m}Tc (89 percent) for a long time. ^{99m}Tc product, which could be eluted from the generator with little volume, is of high radionuclidic and radiochemical purity, thus suitable for the labeling study. With the labeling efficiency and radiochemical purity both reaching more than 96 percent, ^{99m}Tc product was used for preparation of radiopharmaceuticals.

It is worth mentioning that a very efficient way to recycle $^{100/98}$Mo with a high total recovery yield of about 95 percent was realized in the work. In addition, absorption mechanism results indicated that Mo ions reacts strongly with γ-Al_2O_3 and a hydroxyl on the surface of HMMA, simultaneously.

According to the study, the preparation of HMMA is easy, efficient and economical, and is suited for large-scale fabrication of LSA ^{99}Mo/^{99m}Tc generator. This study lays important foundation for the accelerator/reactors-based ^{99}Mo production.

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More information: Jieru Wang et al, Practicality of hierarchically macro/mesoporous γ-Al2O3 as a promising sorbent in the preparation of low specific activity 99Mo/99mTc generator, *Applied Radiation and Isotopes* (2021). DOI: 10.1016/j.apradiso.2021.109986

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