Development of radiometal automated laboratory workbench

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Introduction

Radiometals are finding more and more applications in molecular imaging and targeted therapy. For PET imaging, all the novel radiometals are directly or indirectly produced on cyclotrons. Key step in their production is achieving proper radionuclidic, radiochemical and chemical purity, as well as high specific activity. Automation of the process enhances reproducibility, shortens necessary operations and decreases radiation burden.

We have, therefore, developed universal radiometal automated laboratory workbench (RALW) that is focused on separation processes from solid and liquid (solution) targets via solid phase extraction (SPE).

Material and Methods

RALW is versatile platform for separation, formulation and simple labeling processes. The following FIG. 1 displays its basic scheme.

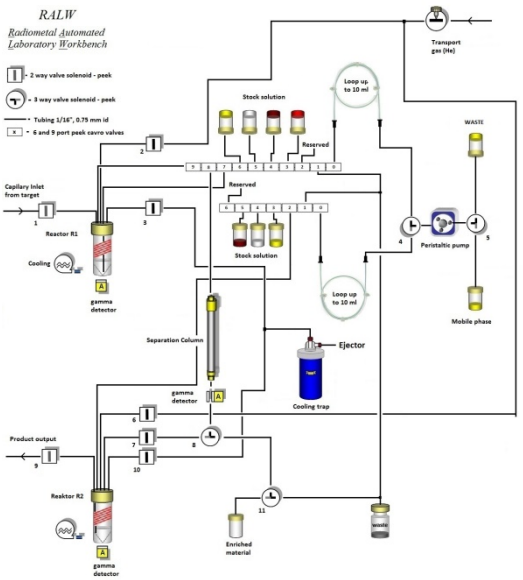

FIGURE 1. Scheme of the RALW

RALW´s main parts are: two reactors, two selectors, peristaltic pump, 3/2 way valves, and separation column.

Prime reactor R1 is designed to carry out several functions. It can transport solid target material from shielding container to process position, or handle liquid target filling. In both cases, the reactor is leakage-free up to 5 bars.

There are 4 positions available to bring solvents to the reactor 1 or applying on a SPE column according to the separation sequence with use of peristaltic pump. Smart software allows for collecting defined fractions leaving the column, e.g. enriched target matrix and the desired radionuclide, by monitoring activity profile and controlling the splitting valves.

The system also minimizes losses during transport of the solvents/fractions to the reactor R2 and the software also controls final volume settings (activity concentration) of the product. Up to three positions are available for bringing solvents/solutions to the reactor R2 for formulation or simple labeling steps like chelation.

The system's hardware is driven by a PLC and I/O cards. The PLC is placed outside the module to avoid radiation damage. The module, PLC and host PC communicate via an Ethernet cable. This solution significantly reduced number of cables connecting the module with other component in the control chain. The PLC is controlled via host PC equipped with user-friendly interface.

Results and Conclusion

The presented RPLW system is rather versatile tool for separation of metal radionuclides and simple post-processing (formulation/labelling) of the product in stable environment and easy control mechanisms. The RPLW operating prototype is shown on the FIG. 2.

FIGURE 2. The RALW prototype

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