Modular fluidic system developed to supply radioisotope used in targeted alpha therapy

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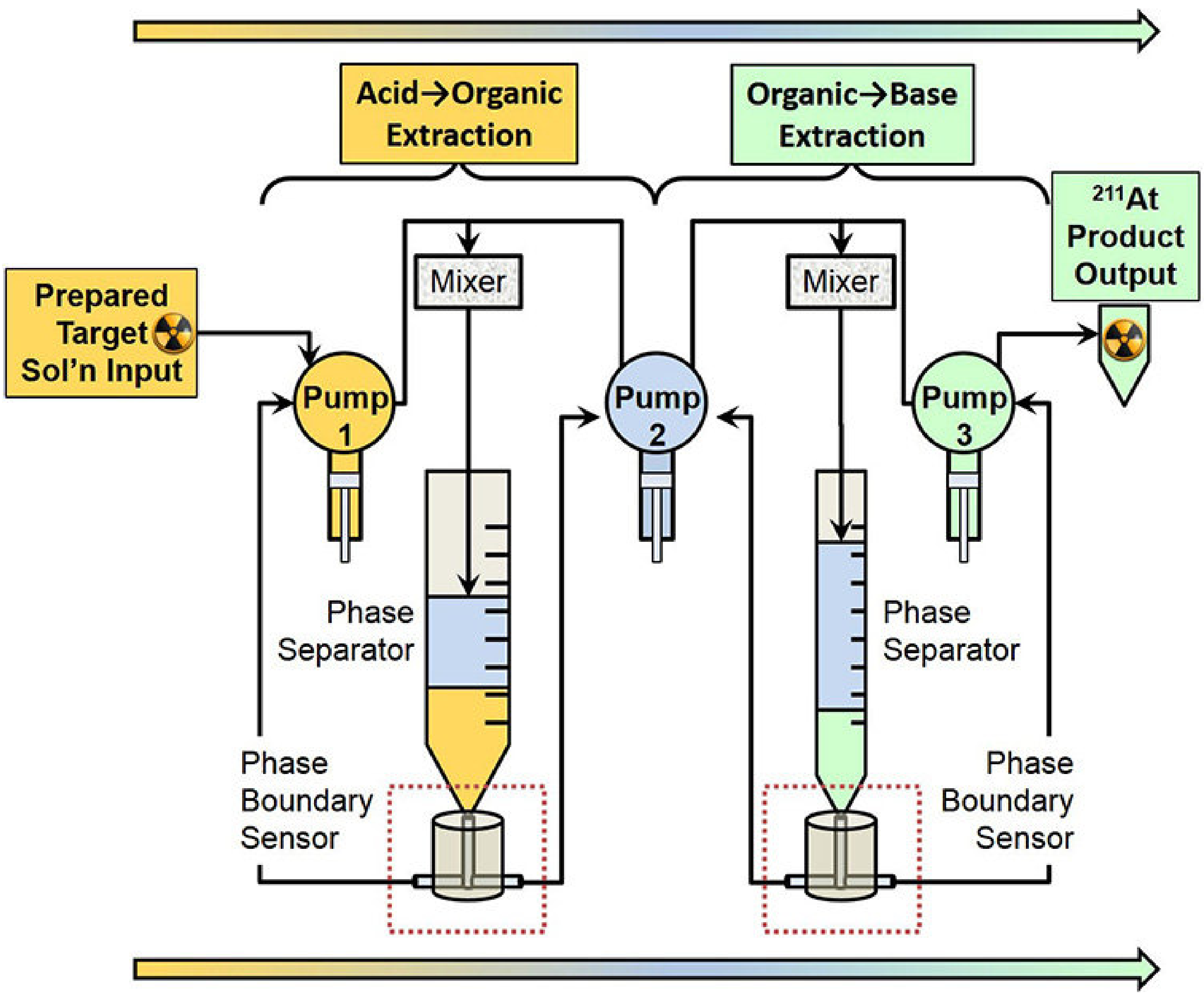

Schematic of solvent extraction module for astatine-211 (211At) isolation from dissolved bismuth cyclotron target. The process starts on the left side and proceeds to the right. Credit: Matthew O'Hara, Pacific Northwest National Laboratory

Astatine-211 shows promise for treating certain cancers, but it's hard to get enough to study. Researchers developed a better way by creating an automated process. The team translated a complex manual chemical process for isolating astatine-211 into three modules that work quickly and efficiently to produce a high-quality product. Currently, the system is being evaluated for its performance and consistency.

Astatine-211 is a potential tool in the battle to treat cancer. It has been used in clinical trials to target and eradicate cancer cells in the body. With a half-life of only ~7 hours, it must be purified and used quickly. To be used in medical applications, it requires timely chemical purification, labeling, transportation, and administration. The new approach is fast and offers a consistent quality product that performs the same as the manually produced product. Also, the new approach protects hospital workers. It reduces radiological dose to personnel and reduces staff fatigue. Now, astatine-211 can be produced on-demand. Such production could aid clinical trials to treat leukemia and lymphoma.

Astatine-211 is produced by alpha beam irradiation of bismuth target material. The University of Washington has one of only a few cyclotrons in the United States configured for production of clinical levels of astatine-211. This facility is a member of the Department of Energy Isotope Program university network. Isolation of astatine-211 from the bismuth target is technically challenging because of the need to perform multiple chemical processing steps within a radiological glovebox. With the assistance of University of Washington collaborators, the research team developed an automated system that combined cyclotron target dissolution, dissolved target matrix transformation, and multiple solvent extraction steps to obtain an isolated astatine-211 product. The team solved issues related to inconsistent target thickness and splatter loss of material. They developed a unique sensor to determine the aqueous/organic solvent interface during solvent extraction to enable autonomous multi-step solvent extraction. The system's performance and consistency is being evaluated at the University of Washington, with anticipation that it may be used to produce astatine-211 for clinical trials.

More information: Matthew J. O'Hara et al. An automated flow system incorporating in-line acid dissolution of bismuth metal from a cyclotron irradiated target assembly for use in the isolation of astatine-211, *Applied Radiation and Isotopes* (2017). DOI: 10.1016/j.apradiso.2017.02.001

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