

ORNL PRODUCTION OF AC-225 FOR MEDICAL APPLICATIONS

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Alpha-emitting radioisotopes linked to targeting antibodies can lead to highly selective treatments for cancer and viral infections. Because of the short range and high-linear-energy transfer of the alpha particles, a high fraction of the decay energy is expended within the targeted cell. The actinium-225/bismuth-213 is an attractive isotope for a number of reasons:

- C Decay to stable bismuth-209 takes place with the emission of one alpha particle and is accompanied by relatively weak beta and gamma emissions.
- C Short 46 minute half-life permits delivery to the targeted cell but avoids accumulation in the rest of the body.
- C Linker chemistry is available to attach bismuth to useful antibodies.

A limited supply (approximately 100 mCi) of Thorium-229 (Th-229), itself a decay product of U-233, has been separated from waste materials presently located at Oak Ridge National Laboratory (ORNL). In June 2000, the U.S. Secretary of Energy announced a program to separate additional thorium to support Phase II human trials at Memorial Sloan-Kettering Cancer Center for the treatment of acute myeloid leukemia as well as other therapeutic applications.

This paper describes continuing efforts to separate additional Th-229 from ORNL U-233 stocks. Extraction of Th-229 has been resumed utilizing a flowsheet involving the dissolving of 200-300 grams of the stored uranium oxide in strong nitric acid. The solution is passed over a ion exchange column where the thorium and plutonium load on the column and uranium, radium, and actinium pass through. Thorium is then eluted from the resin with weak nitric acid. The resulting solution is further purified using an additional ion exchange process to remove residual uranium and plutonium.

This process has been set up and 4 batches of uranium, with 2 ppm of U-232, were processed. Additional new funding will permit additional thorium, and thus additional Ac-225 to be produced. This will support the planned Phase II trials at Sloan-Kettering as well as the continuation of numerous research projects.