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RADIOACTIVE PRODUCT AND METHOD OF PRODUCING THE SAME

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The present invention relates to a radioactive product comprising americium impregnated on a suitable stable carrier, and to a method of producing the same.

One of the chief objects of the present invention is to provide a radioactive product containing americium.

Another object is to provide a process for separating americium from contaminants in a suitably conditioned aqueous solution by utilizing a suitable carrier material.

It is a still further object of the present invention to remove americium from a solution by means of an added carrier of pentavalent tantalum, thereby forming a radioactive product consisting of americium interspersed with the tantalum carrier.

Other objects and advantages will be apparent from a consideration of the following description.

In general, the artificially produced radioactive element americium has a five hundred year half-life and its specific alpha activity amounts to 7.0×10^9 alpha disintegrations per minute per milligram. From a consideration of this property of americium it is evident that when handling this element, even in milligram amounts, special precautions and techniques must be developed and perfected in order to provide adequate protection for the operator.

Since in the art of americium chemistry one is dealing with extremely small amounts of material, it is readily apparent that these amounts may be so small as to defy ordinary physical and chemical manipulations. For example, in the field of radiochemistry, some compounds are obtained in concentrations 10^6 or more times as dilute as those concentrations usually encountered in other fields of chemistry. Accordingly, at such concentrations, precipitation of insoluble compounds usually fails since the attainable initial concentrations of such compounds are less than those required for precipitation. In this connection, in addition to the all-important safety considerations which must be constantly observed, serious problems regarding adsorption of trace material on the walls of the container are encountered. Moreover, the actual physical manipulations, such as filtering, transferring from one vessel to another, and the like, necessitate the development of special techniques substantially different from those normally used in the macro-chemical field.

From the foregoing, it is evident that conventional means and practices are generally inadequate for removal of small amounts of this

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highly radioactive element from solution while simultaneously forming a suitable radioactive product having the property of retaining the valuable americium. I have now discovered that certain substances when placed in contact with trace amounts of radioactive americium have the ability to cause the americium to become associated therewith by various mechanisms which at present are not well understood. These substances are generally termed "carriers"; i. e., these substances "carry" the associated trace amounts of americium along with them through various chemical and physical operations during particular processes. It has also been found that the trace amounts of americium can be embodied with their carriers, and from this property it is possible by using such a carrier to increase the quantities involved so that standard chemical and physical means may appropriately be employed to process the americium.

In carrying out my invention, a solution of americium is treated with a suitable oxidizing agent in order to oxidize the americium to the pentavalent state. The solution is then heated to a temperature of from 50°C. to 100°C. and to it is added a solution containing tantalum, also in the pentavalent state. Heating is continued and the tantalum precipitates from solution. The resulting pentavalent tantalum precipitate, probably a hydrated oxide, carries with it the pentavalent americium. The precipitate comprising americium and its tantalum carrier are removed from the solution in any appropriate conventional manner, preferably by centrifuging the mixture. This precipitate comprises a separate article of commerce which may serve as a means for storing, retaining, or handling americium, as an intermediate or as a product useful for any purpose relying upon the intense radioactivity of the retained americium.

Example.—A 5 microliter portion of an aqueous americium solution containing about 5 micrograms of pentavalent americium per milliliter is heated at 95°C. for five minutes. About 2 microliters of a 2.75 M K_2CO_3 solution of pentavalent tantalum containing 75 milligrams of tantalum per milliliter is added. The resulting solution is heated for at least one-half hour and then centrifuged. Alpha analysis of approximately 1 microliter portions indicate that about 20% of the pentavalent americium is carried.

The herein disclosed process for the manufacture of a radioactive product of americium should not be construed as being restricted to laboratory investigations of americium merely

because the phenomenon of "carrying" is associated with microscopic or trace amounts. On the contrary, it is to be stressed that in industrial as well as research processes involving the use of radioactive materials such as americium, the amounts involved are extremely small because of the great expense and health hazard involved.

While the salient features of this invention have been described in detail with respect to one embodiment, it will, of course, be apparent that numerous modifications may be made within the spirit and scope of this invention, and it is not therefore desired to limit the invention to the exact details shown, except in so far as they may be defined in the following claims.

What is claimed is:

1. A radioactive product comprising a hydrated pentavalent tantalum oxide precipitate carrying americium values in which the amount of said americium is less than the amount of tantalum contained therein.

2. In a process for the production of a radioactive composition containing tantalum and americium, the steps comprising mixing a carbonate solution of pentavalent tantalum ions with a solution containing pentavalent americium ions, and heating said solution to precipitate tantalum as a hydrated oxide thereby carrying americium from the solution.

3. In a process for the production of a radioactive product comprising americium values carried by a hydrated pentavalent tantalum oxide, the steps comprising mixing a carbonate solution containing pentavalent tantalum ions with a

solution containing pentavalent americium ions while the latter solution is at a temperature in the range of about 50° C. to 100° C., heating said solution to precipitate the tantalum ions as a hydrated oxide thereby carrying said americium ions from the solution, and separating the precipitate from said solution.

4. In a process for the production of a radioactive composition, the steps comprising, mixing a heated solution containing pentavalent americium ions with a carbonate solution containing pentavalent tantalum ions, and precipitating said tantalum ions by heating said solution thereby carrying americium as a hydrated oxide from said solution.

5. The radioactive product comprising pentavalent americium values carried by a hydrated pentavalent tantalum oxide precipitate.

6. In a process for the manufacture of a radioactive product, the steps comprising mixing a heated solution containing about 5 micrograms per milliliter of pentavalent americium ions with an amount of a 2.75 M potassium carbonate solution containing about 75 milligrams per milliliter of pentavalent tantalum ions equivalent to about four-tenths of its own volume, heating said mixed solutions for at least one half hour to precipitate said pentavalent tantalum ions and thereby carry said americium ions from the solution, and separating the precipitate from said solution.

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No references cited.