PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : G01N 23/10

A1

(11) International Publication Number: WO 94/20839

(43) International Publication Date: 15 September 1994 (15.09.94)

(21) International Application Number: PCT/US94/02485

(22) International Filing Date: 9 March 1994 (09.03.94)

(30) Priority Data:
08/030,502 12 March 1993 (12.03.93) US

(71) Applicant: AKZO AMERICA INC. [US/US]; 300 S. Riverside Plaza, Chicago, IL 60606 (US).

(72) Inventor: GEERLINGS, Maurits, W.; Steenhoek 18, NL-6891 CG Rozendaal (NL).

(74) Agent: FENNELLY, Richard, P.; Akzo America Inc., 7 Livingstone Avenue, Dobbs Ferry, NY 10522 (US).

(81) Designated States: European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: PROCESS FOR STRIPPING RADON-220 FROM RADIOACTIVE ISOTOPE MIXTURE

(57) Abstract

The separation of radon-220 from a liquid radioactive composition comprising radon-220, radium-224, and radium-225, and their daughter isotopes, as well as may be their thorium precursors, which liquid radioactive composition is adapted for use in the ultimate production of actinium-225 for radioimmunotherapy, can be achieved by treating the composition with a gas to strip the radon-220 from the composition.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**GB**	United Kingdom	**MR**	Mauritania
AU	Australia	**GE**	Georgia	**MW**	Malawi
BB	Barbados	**GN**	Guinea	**NE**	Niger
BE	Belgium	**GR**	Greece	**NL**	Netherlands
BF	Burkina Faso	**HU**	Hungary	**NO**	Norway
BG	Bulgaria	**IE**	Ireland	**NZ**	New Zealand
BJ	Benin	**IT**	Italy	**PL**	Poland
BR	Brazil	**JP**	Japan	**PT**	Portugal
BY	Belarus	**KE**	Kenya	**RO**	Romania
CA	Canada	**KG**	Kyrgystan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SI**	Slovenia
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SK**	Slovakia
CM	Cameroon	**LI**	Liechtenstein	**SN**	Senegal
CN	China	**LK**	Sri Lanka	**TD**	Chad
CS	Czechoslovakia	**LU**	Luxembourg	**TG**	Togo
CZ	Czech Republic	**LV**	Latvia	**TJ**	Tajikistan
DE	Germany	**MC**	Monaco	**TT**	Trinidad and Tobago
DK	Denmark	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**US**	United States of America
FI	Finland	**ML**	Mali	**UZ**	Uzbekistan
FR	France	**MN**	Mongolia	**VN**	Viet Nam
GA	Gabon				

PROCESS FOR STRIPPING RADON-220 FROM RADIOACTIVE ISOTOPE MIXTURE

BACKGROUND OF THE INVENTION

It is known from PCT International Application No. WO 90/15625 to conduct radioimmunotherapy using actinium-225, or one of its daughters, as the alpha-particle source in a radioimmunoconjugate which also comprises a chelating agent and a tumorspecific antibody. In addressing some of the disadvantages of previously proposed alpha-particle emitters, this patent application identifies radon-220, a highly radioactive inert (noble) gas from the decay chain of thorium-228 and radium-224, as an undesired by-product of producing bismuth-212, for example. The occurrence of radon-220 in a decay chain requires special shielding and containment facilities if used in a hospital setting for example.

The above-mentioned patent application teaches the use of uranium-233, which is relatively abundantly stockpiled as an unused source of fuel for nuclear breeder reactors. The use of this material as a source for the actinium-225, through its intermediate decay product thorium-229, is said to possess a number of advantages, including the production of no significant amounts of noble gas isotopes, such as radon-220.

Unfortunately, the availability of uranium-233 as a starting material for the manufacture of the desired intermediate product, thorium-229, as a source for the actinium-225 may be quite limited due to governmental security regulations, on the one hand, and a potentially largely increased demand for this material, on the other hand. Hence, there is a need for non-controlled alternative source materials of greater availability.

The use of radium-226 will cope with the availability issue. Its irradiation by neutrons in a nuclear high flux reactor will generate the needed thorium-229. But the co-generation of comparable amounts of thorium-228 causes the occurrence of radon-220 as one of the decay products in this product mix. Both thorium isotopes decay in a relatively large cascade, starting with radium isotope, being radium-225 from thorium-229 and radium-224 from thorium-228. It is the decay train of undesired radium-224 which is responsible for the production of the undesired radon-220.

DESCRIPTION OF THE INVENTION

The present invention provides a convenient way in which to achieve the removal of the undesired radon-220 from a radioactive, liquid composition comprising radon-220, radium-224, and radium-225 which comprises treating the composition with a gas to strip the radon-220 from the composition. In this manner, the use of radium-226 as a feed source for the thorium-229 will be greatly facilitated and the serious problem in regard to the undesired presence of radon-220 in the isotope mixture of radium-224 and radium-225 be minimized.

Upon reading the present description of the result to be achieved in accordance with the present invention, namely, the stripping of the undesired radon-220 from the radioactive isotope mixture, the person of ordinary skill in the art will be able to devise means for accomplishing such a result with relative ease. A wide variety of sparging gases can be used including air or inert gases, such as nitrogen, helium, and the like. The temperature conditions are not critical although ambient temperatures are preferred since cooling and heating are not required with such conditions. The flow rate

of gas to be employed will also variable depending upon the rate of radon-220 removal desired.

The foregoing description has been provided to illustrate certain embodiments of the present invention and, for that reason should not be construed in a limiting sense. The scope of protection is set forth in the claims which follow.

I Claim:

1. A process for the separation of radon-220 from a liquid radioactive composition comprising radon-220, radium-224, and radium-225, which liquid radioactive composition is adapted for use in the ultimate production of actinium-225 for radioimmunotherapy, which separation process comprises treating the composition with a gas to strip the radon-220 from the composition.

2. A process as claimed in Claim 1 wherein the gas is air.

3. A process as claimed in Claim 1 wherein the treatment is conducted at ambient temperature.

4. A process as claimed in Claim 1 where the gas is air and the treatment is conducted at ambient temperature.

5. A process as claimed in Claim 1 wherein the gas is an inert gas.

6. A process as claimed in Claim 1 where the gas is inert gas and the treatment is conducted at ambient temperature.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/02485

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :G01N 23/10
US CL :250/432PD

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S.CL: 250/432PD

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS (Seperat? or Strip?) (4A) (Radon-220 or 220RN); 220(w)RN; Radium-224 or Radium 225; Gas (3A) (Airor(inert(w)gas); Ambient(w)Temperature

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P	US,A, 5,235,190 (Tucker et al.) 10 August 1993. See col. 1, lines 10-13	1-6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 16 MAY 1994	Date of mailing of the international search report 19 MAY 1994
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer BRUCE C. ANDERSON Telephone No. (703) 308-4851

Form PCT/ISA/210 (second sheet)(July 1992)*