Device for eluting nuclide generators comprising a nuclide generator, conveying means, container for eluting agent, and eluate container, wherein the container for the eluting agent, the eluate container and the conveying means are connected with the nuclide generator by conduits, the conveying means are mounted between the container for the eluting agent and the eluate container and the conveying means comprise a control mechanism which permits to convey freely chosen amounts of eluate into the eluate container.

4 Claims, 8 Drawing Figures
ELUTING DEVICE FOR NUCLIDE GENERATORS

The present invention relates to a device for eluting nuclide generators.

Nuclide generators serve to apply radio-nuclides of short life time in medicine and technics. A radio-active mother nuclide of longer life time produces a short lived daughter nuclide which can repeatedly be eluted by a separating column. By a closed sterile system composed of eluting agent, column, eluate container and transfer system eluates are obtained which can be injected or are suitable for making injectable preparations.

Devices are known wherein the eluate container is positioned above the nuclide generator which is eluted by the hydrostatic pressure of the eluting agent. The elution rate depends on the generator resistance and, therefore, it is not constant. In this manner fractional elution is however possible.

In other known devices the eluate container is evacuated so that the eluting agent is sucked through the column. The flowing rate of the eluting agent is not constant and fractional elution is difficult.

Devices have also become known in which the eluting agent is pressed through the nuclide generator by means of an injection syringe. The repeated piercing of the generator seal involves the danger of unsterility. The elution rate depends on the resistance of the column and the pressure of the piston.

Finally, devices have been proposed in which the eluting agent is pressed through the generator by a piston pump, wherein the danger of unsterility is given by the moving piston of the pump.

In order to overcome the aforesaid difficulties in the known devices, the invention provides a device for eluting nuclide generators wherein the container for the eluting agent, the container for the eluate and the conveying means are connected with the nuclide generator by conduits, the conveying means are positioned between the container for the eluting agent and the container for the eluate, and the conveying means comprise a control device allowing of conveying freely eligible amounts of eluate into the eluate container.

According to a variant of the device of the invention the conveying means are arranged between the container for the eluting agent and the nuclide generator. Alternatively, the conveying means can be installed between the nuclide generator and the eluate container.

It proved advantageous to branch off a conduit to the conveying means from the conduit connecting the nuclide generator with the eluate container. It is of advantage to seal the conveying means hermetically with respect to the outside and to operate it electrically. Nuclide generator, container for eluting agent, conveying means and eluate container are preferably connected with one another by means of plug connections. The eluate container should be placed in a transparent casing protecting against radiation.

It has also been found that an especially good eluate, a greater variability of the eluate properties and an optimum working safety are obtained by using a tube pump. The tube pump has the property to convey, independent of the flow resistance of the column, a constant mass flow. The constant mass flow produces a uniform activity distribution. Thus the minimum amount of eluting agent required for an adequate yield can be exactly ascertained and hence the column may be kept small. The good reproducibility further permits to find with certainty the desired activity concentration with fractional elution. Owing to the exact dosing, additional amounts to ensure a minimum yield need not be used. The high pump pressure permits to use fine-grained and hence very active ion exchangers and other active substances for the column. With the high permissible pressure loss in the column greater ratios of column length to column cross section can be used. Finally, the high pump pressure allows of installing filters.

Owing to the uniform and adjustable pumping velocity even with counter pressure it is possible to eluate directly into injection syringes or into conduit systems or into the organism. The pump also permits to reactivate the eluate to the column so that fractional elution can be carried out without loss in activity and with simple operation. The recycling of the eluate can also be used for a complete mixing of the activity. This results in an even activity concentration and permits the direct filling of syringes with determined activity amounts and the withdrawal of activity as needed.

In spite of the greater variability of the eluate properties the device of the invention offers a great security as regards the course of operation and protection against radiation.

The device of the invention will now be described in further detail and by way of example with reference to the accompanying drawings wherein:

FIG. 1 is a simplified representation of the mode of operation of the device.

FIG. 2 is a sectional view of the device according to the invention.

FIG. 3 is a top view of the device according to the invention.

FIG. 4 is a fragmentary sectional view of a variant of the device as shown in FIG. 2.

FIG. 5 illustrates a mode of execution of the shut off valves.

FIG. 6 represents the tube pump with lubricating means.

FIG. 7 is a fragmentary sectional view of the generator connection.

FIG. 8 is a fragmentary sectional view of a special embodiment of the supply section of the device shown in FIG. 2.

A container 1 for the eluting agent, preferably a bag of plastic material provided with an impervious junction 2 which can be pierced by a hollow needle is connected with a conduit 4 by an injection needle 3. Conduit 4 has a fix point 5 to which a conduit 8 is connected leading to the conveying device 9. As conveying devices rotary pumps with small dead volume and hermetically sealed with respect to the outside can be used, for example tube pumps, diaphragm pumps, or bellows pumps, a statorless tube pump being especially suitable. The preferably three cornered pump impeller carries an absorbent layer 10, for example a sponge, tissue, or hide, for a lubricating liquid, for example glycerol, which continuously lubricates the pump hose 8 preferably made of silicone rubber or a similar elastic material.

From the conveying device the current of conveyed fluid is passed over a second fix point 11, which provides for the right tension of the tube together with fix point 5, and through conduit 12 it arrives at the entrance of nuclide generator 13. The nuclide generator
In a particularly advantageous variant of the device 1, 6 injection syringes of high activity and ready for immediate use are to be filled within a period of 5 hours at equal intervals.

First at the selecting disk 28 a high amount by volume is set, for example 23 milliliters. Next, without connecting eluate container 21 to valve stopper 7, push-button switch 29 is actuated whereby a mixing process is started since the eluate flows back through conduit 6 to the entrance of the nuclide generator. The uniform activity concentration would permit to take with several injection syringes up to about 70% of the activity capable of being washed out. As it is only desired, however, to take 6.3 mCi the required amount is set on selecting disk 28, injection syringe 26 is pushed through valve stopper 7 and push-button switch 29 is actuated. In this manner 6 times 6.2 mCi are obtained, with 6 grams of aluminum oxide and having 1 milliliter per hour 48% more activity can be brought into action in the desired case under approximately the same conditions, with 65% of the activity remaining in the eluate container 21.

If this example were carried out in the manner described in Example 1, 6 times 4.25 mCi could be taken. In both cases the activity concentration is approximately equal. With the first extraction the activity concentration according to Example 2 is by 7% higher and with the last extraction by 7% lower than in Example 1.

Hence, when proceeding as described in Example 2, 48% more activity can be brought into action in the given case under approximately the same conditions. What is claimed is:

1. A device for eluting nuclide generators comprising a radiation shield container having an open top, a nu-
elide generator positioned in said container; a housing
removably mounted on said container adjacent said
open top and including a container for an eluting agent,
a container for receiving eluate from said generator, a
plurality of conduits connecting said eluting agent con-
tainer through said open top to said generator and said
generator to said eluate container, and pump means
mounted in said housing and operatively connected to
said conduits for pumping liquid therethrough; said
pump means including selectively operable control
means for limiting operation of said pump to pump only
a predetermined amount of eluate into the eluate con-
tainer said pump means being installed in said housing
between the container for the eluting agent and the
container for said nuclide generator and being opera-
tively associated with the conduit therebetween; and
said conduit connecting the nuclide generator with the
eluate container including a branching conduit con-
ected to the conduit connecting the nuclide generator
with the container for eluting agent, thereby to provide
a recirculating path between said housing and said gen-
erator.

2. The device of claim 1, wherein said pump means
comprises an electrically driven pump which is hermet-
ically sealed in said housing.

3. The device of claim 1, wherein the nuclide genera-
tor, the container for the eluting agent, the pump
means and the eluate container are connected with one
another by socket connections associated with said
conduits.

4. The device of claim 1, wherein the eluate con-
tainer is in a transparent radiation protecting container.

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