Claims:

1) A method for generating a purified solution of at least one alpha-emitting radionuclide, said method comprising contacting a solution comprising said least one alpha-emitting radionuclide complex and at least one daughter nuclide with at least one selective binder for said at least one daughter nuclide and subsequently separating said solution of at least one alpha-emitting radionuclide complex from said at least one selective binder.

2) A method for reducing the radiolysis of at least one organic component in a solution comprising at least one alpha-emitting radionuclide complex, at least one daughter radionuclide and at least one organic component, said method comprising contacting said solution with at least one selective binder for said at least one daughter nuclide.

3) A method for the removal of at least one daughter radionuclide from a solution comprising at least one alpha-emitting radionuclide complex, said method comprising contacting said solution with at least one selective binder for said at least one daughter nuclide.

4) A method as claimed in claim 2 or claim 3 wherein said solution is a pharmaceutical preparation.

5) A method as claimed in any of claims 2 to 4 further comprising separating said solution from said selective binder.

6) A method as claimed in any preceding claim wherein said alpha-emitting radionuclide is in the form of a complex with a ligand, wherein said ligand is conjugated to a specific binding moiety (such as an antibody).

7) A method as claimed in any preceding claim wherein said selective binder is in the form of, or is attached to, a solid support or gel support.

8) A method as claimed in claim 7 wherein said solid or gel support is in the form of, or attached to, least one selected from membranes, resin beads, gel beads, self-assembled lipid structures (e.g. liposomes), microparticles, nanoparticles, powders, crystals, ceramics and polymer structures.

9) A method as claimed in any preceding claim wherein said selective binder comprises at least one selected from cation exchange resins, size exclusion resins, zeolites, molecular sieves, hydroxyapatite, alginates, liposomes, phosphonates, polyphosphonates, phospholipids, glycolipids, lipo-proteins, oligosaccharides, ferritin, transferrin, phytic acid and co-precipitation agents.

10) A method as claimed in any preceding claim wherein said solution is contacted with said selective binder by means of flow of said solution through or past said selective binder or through or past a support upon which said selective binder is immobilised.

11) A method as claimed in claim 10 wherein said contacting is by means of a filtration in which said solution flows through or past said selective binder or through or past a support upon which said selective binder is immobilised.

12) A method as claimed in claim 11 wherein said filtration further comprises flowing said solution through a sterile filtration membrane.

13) A method as claimed in any preceding claim wherein said contacting takes place for a period of less than 30 minutes, such as less than 10 minutes, e.g. less than 5 minutes or less than 1 minute (e.g. no more than 30 seconds).

14) A method as claimed in any of claims 1 to 9 wherein said solution is contacted with said selective binder by means of addition of said selective binder and said solution to a vessel (e.g. a sealed or partially sealed vessel).

15) A method as claimed in claim 14 wherein said contacting takes place for 30 minutes or longer, (e.g. 1 hour or longer, such as 1 day or longer).

16) A method as claimed in any preceding claim wherein said alpha-emitting radioisotope is comprises at least one alpha-emitting thorium isotope, such as ^{227}Th.

17) A method as claimed in any preceding claim wherein said at least one daughter nuclide comprises at least one radium isotope, such as ^{223}Ra.

18) A kit for the formation of a pharmaceutical preparation of at least one alpha-emitting radioisotope complex, said kit comprising:

i) a solution of said at least one alpha-emitting radioisotope and at least one daughter isotope;
ii) at least one ligand;
ii) a specific binding moiety;
iii) at least one selective binder for said at least one daughter isotope.

wherein said alpha-emitting radioisotope is complexed or complexable by said ligand which is conjugated or conjugatable to said specific binding moiety.

19) A kit as claimed in claim 18 wherein said solution of said at least one alpha-emitting radioisotope and at least one daughter isotope is present in a first vessel (e.g. vial, syringe etc) and said ligand conjugated to said specific binding moiety is present in a second vessel.

20) A kit as claimed in claim 18 or claim 19 wherein said selective binder is present in the form of at least one filter, such as a syringe filter, through which said solution of alpha-emitting radioisotope can be passed after complexation by said ligand and optionally after conjugation to said specific binding moiety.

21) A kit as claimed in claim 18 or claim 19 wherein said selective binder is present in the form of or attached to at least one solid or gel support.

22) A kit as claimed in claim 21 wherein said selective binder is present in said first vessel.

23) A kit as claimed in any of claims 18 to 22 wherein said selective binder arranged to be separated from said solution by the process of administration of said solution.

24) A kit as claimed in claim 23 wherein said solid or gel support is least one selected from membranes, resin beads, gel beads, self-assembled lipid structures (e.g. liposomes), microparticles, nanoparticles, powders, crystals and polymer structures.

25) A kit as claimed in any of claims 18 to 24 wherein said selective binder comprises at least one selected from cation exchange resins, size exclusion resins, zeolites, molecular sieves, hydroxyapatite, alginates, liposomes, phosphonates, polyphosphonates, phospholipids, glycolipids, lipo-proteins, oligosaccharides, ferritin, transferrin, phytic acid and co-precipitation agents.

26) A kit as claimed in any of claims 18 to 25 wherein said alpha-emitting radioisotope is at least one thorium radioisotope such as ^{227}Th.

27) A kit as claimed in any of claims 18 to 26 wherein said daughter isotope is at least one radium isotope, such as ^{223}Ra.

28) A kit as claimed in any of claims 18 to 27 additionally comprising a filter and/or an administration device.

29) A kit as claimed in any of claims 18 to 28 comprising a filter of pore size of no larger than 0.22 μm

30) An administration device comprising a solution of at least one alpha-emitting radionuclide complex and at least one daughter nuclide, said device further comprising a filter containing at least one selective binder for said daughter nuclide.

31) A device as claimed in claim 30 in the form of a disposable syringe and syringe filter.

32) A kit as claimed in any of claims 18 to 29 comprising an administration device comprising a solution of at least one complexed alpha-emitting radionuclide and at least one daughter nuclide, said kit further comprising a selective binder for said daughter nuclide in the form of a filter.

33) A method for the formation of an injectable solution of an alpha-radionuclide complex comprises the steps of:

a) combining a first solution comprising a dissolved salt of an alpha-emitting radionuclide and at least one daughter nuclide with a second solution comprising at least one ligand conjugated to at least one targeting moiety;

b) Iincubating the combined solutions at a suitable temperature (e.g. 0°C to 50°C, preferably 20°C to 40°C) for a period to allow complex formation between said ligand and said alpha-emitting radioisotope whereby to form a solution of at least one alpha-emitting radioisotope complex;

c) contacting said solution of at least one alpha-emitting radioisotope complex with at least one selective binder for at least one of said daughter nuclides.

d) separating said solution of at least one alpha-emitting radionuclide complex from said at least one selective binder.

34) A method for the formation of an injectable solution as claimed in claim 33 wherein steps c) and d) comprise a method for generating a purified solution as claimed in any of claims 1 to 17.

Claims:

1) A method for generating a purified solution of at least one alpha-emitting radionuclide, said method comprising contacting a solution comprising said least one alpha-emitting radionuclide complex and at least one daughter nuclide with at least one selective binder for said at least one daughter nuclide and subsequently separating said solution of at least one alpha-emitting radionuclide complex from said at least one selective binder, with the proviso that the selective binder does not comprise any alginate.

2) A method for reducing radiolysis of at least one organic component in a solution comprising at least one alpha-emitting radionuclide complex, at least one daughter radionuclide and at least one organic component, said method comprising contacting said solution with at least one selective binder for said at least one daughter nuclide, with the proviso that the selective binder does not comprise any alginate.

3) A method for removal of at least one daughter radionuclide from a solution comprising at least one alpha-emitting radionuclide complex, said method comprising contacting said solution with at least one selective binder for said at least one daughter nuclide, with the proviso that the selective binder does not comprise any alginate.

4) A method as claimed in claim 2 or claim 3 wherein said solution is a pharmaceutical preparation.

5) A method as claimed in any of claims 2 to 4 further comprising separating said solution from said selective binder.

6) A method as claimed in any preceding claim wherein said alpha-emitting radionuclide is in the form of a complex with a ligand, wherein said ligand is conjugated to a specific binding moiety.

7) A method as claimed in any preceding claim wherein said selective binder is in the form of, or is attached to, a solid support or gel support.

8) A method as claimed in claim 7 wherein said solid or gel support is in the form of, or attached to, least one selected from membranes, resin heads, gel heads, self-assembled lipid structures, microparticles, nanoparticles, powders, crystals, ceramics and polymer structures.

9) A method as claimed in any preceding claim wherein said selective binder comprises at least one selected from cation exchange resins, size exclusion resins, zeolites, molecular sieves, hydroxyapatite, , liposomes, phosphonates, polyphosphonates, phospholipids, glycolipids, lipo-proteins, oligosaccharides, ferritin, transferrin, phytic acid and co-precipitation agents.

10) A method as claimed in any preceding claim wherein said solution is contacted with said selective binder by means of flow of said solution through or past said selective binder or through or past a support upon which said selective binder is immobilized.

11) A method as claimed in claim 10 wherein said contacting is by means of a filtration in which said solution flows through or past said selective binder or through or past a support upon which said selective binder is immobilized.

12) A method as claimed in claim 11 wherein said filtration further comprises flowing said solution through a sterile filtration membrane.

13) A method as claimed in any preceding claim wherein said contacting takes place for a period of less than 30 minutes, such as less than 10 minutes, e.g. less than 5 minutes or less than 1 minute.

14) A method as claimed in any of claims 1 to 9 wherein said solution is contacted with said selective binder by means of addition of said selective binder and said solution to a vessel.

15) A method as claimed in claim 14 wherein said contacting takes place for 30 minutes or longer.

16) A method as claimed in any preceding claim wherein said alpha-emitting radioisotope is comprises at least one alpha-emitting thorium isotope, such as ^{227}Th.

17) A method as claimed in any preceding claim wherein said at least one daughter nuclide comprises at least one radium isotope, such as ^{223}Ra.

18) A kit for the formation of a pharmaceutical preparation of at least one alpha-emitting radioisotope complex, said kit comprising:

i) a solution of said at least one alpha-emitting radioisotope and at least one daughter isotope;
ii) at least one ligand;
ii) a specific hinding moiety;
iii) at least one selective binder for said at least one daughter isotope.

wherein said alpha-emitting radioisotope is complexed or complexable by said ligand which is conjugated or conjugatable to said specific binding moiety, with the proviso that the selective binder does not comprise any alginate.

19) A kit as claimed in claim 18 wherein said solution of said at least one alpha-emitting radioisotope and at least one daughter isotope is present in a first vessel and said ligand conjugated to said specific binding moiety is present in a second vessel.

20) A kit as claimed in claim 18 or claim 19 wherein said selective binder is present in the form of at least one filter, such as a syringe filter, through which said solution of alpha-emitting radioisotope can he passed after complexation by said ligand and optionally after conjugation to said specific binding moiety.

21) A kit as claimed in claim 18 or claim 19 wherein said selective binder is present in the form of or attached to at least one solid or gel support.

22) A kit as claimed in claim 21 wherein said selective binder is present in a first vessel.

23) A kit as claimed in any of claims 18 to 22 wherein said selective binder arranged to be separated from said solution by the process of administration of said solution.

24) A kit as claimed in claim 23 wherein said solid or gel support is least one selected from membranes, resin beads, gel beads, self-assembled lipid structures, microparticles, nanoparticles, powders, crystals and polymer structures.

25) A kit as claimed in any of claims 18 to 24 wherein said selective binder comprises at least one selected from cation exchange resins, size exclusion resins, zeolites, molecular sieves, hydroxyapatite, , liposomes, phosphonates, polyphosphonates, phospholipids, glycolipids, lipo-proteins, oligosaccharides, ferritin, transferrin, phytic acid and co-precipitation agents.

26) A kit as claimed in any of claims 18 to 25 wherein said alpha-emitting radioisotope is at least one thorium radioisotope such as ^{227}Th.

27) A kit as claimed in any of claims 18 to 26 wherein said daughter isotope is at least one radium isotope, such as ^{223}Ra.

28) A kit as claimed in any of claims 18 to 27 additionally comprising a filter and/or an administration device.

29) A kit as claimed in any of claims 18 to 28 comprising a filter of pore size of no larger than 0.22 μm

30) An administration device comprising a solution of at least one alpha-emitting radionuclide complex and at least one daughter nuclide, said device further comprising a filter containing at least one selective binder for said daughter nuclide, with the proviso that the selective binder does not comprise any alginate.

31) A device as claimed in claim 30 in the form of a disposable syringe and syringe filter.

32) A kit as claimed in any of claims 18 to 29 comprising an administration device comprising a solution of at least one complexed alpha-emitting radionuclide and at least one daughter nuclide, said kit further comprising a selective binder for said daughter nuclide in the form of a filter.

33) A method for the formation of an injectable solution of an alpha-radionuclide complex comprises the steps of:

a) combining a first solution comprising a dissolved salt of an alpha-emitting radionuclide and at least one daughter nuclide with a second solution comprising at least one ligand conjugated to at least one targeting moiety;

b) incubatingthe combined solutions at a suitable temperature for a period to allow complex formation between said ligand and said alpha-emitting radioisotope whereby to form a solution of at least one alpha-emitting radioisotope complex;

c) contacting said solution of at least one alpha-emitting radioisotope complex with at least one selective binder for at least one of said daughter nuclides, with the proviso that the selective binder does not comprise any alginate;

d) separating said solution of at least one alpha-emitting radionuclide complex from said at least one selective binder.

34) A method for the formation of an injectable solution as claimed in claim 33 wherein steps c) and d) comprise a method for generating a purified solution as claimed in claim 1.