CLAIMS

1. A method for producing a radioactive zirconium complex, the method comprising: a step of reacting a radioactive zirconium ion and a ligand compound with each other in a reaction solution containing water to coordinate the radioactive zirconium ion to the ligand compound,

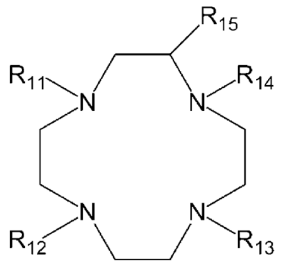
wherein the reaction solution contains no organic solvent,

the reaction solution contains:

the ligand compound; and

a water-soluble organic compound having one or two sulfo groups or a water-soluble organic compound having one or two carboxy groups, and

a pH of the reaction solution is 2.0 or more and 6.0 or less, wherein the ligand compound is represented by Formula (1) below:



(1)

wherein R_{11}, R_{12}, and R_{13} each independently represent a $-(CH_2)_pCOOH$ group, a$-(CH_2)_pC_5H_4N$ group, a $-(CH_2)_pPO_3H_2$ group, or a $-(CH_2)_pCONH_2$ group,

one of R_{14} and R_{15} represents a hydrogen atom, a $-(CH_2)_pCOOH$ group, a $-(CH_2)_pC_5H_4N$ group, a $-(CH_2)_pPO_3H_2$ group, a $-(CH_2)_pCONH_2$ group, or a $-(CHCOOH)(CH_2)_pCOOH$ group, the other one represents a $-(CH_2)_pCOOH$ group, a $-(CH_2)_pC_5H_4N$ group, a $-(CH_2)_pPO_3H_2$ group, a $-(CH_2)_pCONH_2$ group, a reactive atomic group to be linked to a targeting agent, or a group linked to the targeting agent, and p is each independently an integer of 0 or more and 3 or less.

2. The method for producing a radioactive zirconium complex according to claim 1, wherein a concentration of the water-soluble organic compound contained in the reaction solution is 0.01 mol/L or more and 2.0 mol/L or less.

3. The method for producing a radioactive zirconium complex according to claim 1

or 2, wherein the water-soluble organic compound includes acetic acid, phthalic acid, or malonic acid, or 2-[4-(2-hydroxyethyl)-1-piperazinyl]ethanesulfonic acid, N-tris(hydroxymethyl)methyl-2-aminoethanesulfonic acid, or 2-morpholinoethanesulfonic acid.

4. The method for producing a radioactive zirconium complex according to any one of claims 1 to 3, wherein the reaction solution is heated to 30°C or higher and 100°C or lower to react the radioactive zirconium ion with the ligand compound.

5. The method for producing a radioactive zirconium complex according to any one of claims 1 to 4,

wherein in the formula, all of R_{11}, R_{12}, and R_{13} represent $-(CH_2)_pCOOH$ groups,

one of R_{14} and R_{15} represents a hydrogen atom or a $-(CH_2)_pCOOH$ group,

the other of R_{14} and R_{15} represents a $-(CH_2)_pCOOH$ group, the reactive atomic group to be linked to the targeting agent or the group linked to the targeting agent,

R_{15} represents a hydrogen atom in a case where R_{14} represents the reactive atomic group to be linked to the targeting agent or the group linked to the targeting agent, and

R_{14} represents a hydrogen atom in a case where R_{15} represents the reactive atomic group to be linked to the targeting agent or the group linked to the targeting agent.

6. The method for producing a radioactive zirconium complex according to any one of claims 1 to 5, wherein the targeting agent includes an atomic group containing one or two or more selected from the group consisting of a chain peptide, a cyclic peptide, or a combination thereof, a protein, an antibody or a fragment thereof, a growth factor, Affibody, UniBody, Nanobody, a monosaccharide, a polysaccharide, a vitamin, an antisense nucleic acid, a siRNA, a miRNA, a nucleic acid aptamer, a decoy nucleic acid, a cPG oligonucleic acid, a peptide nucleic acid, a liposome, a micelle, a carbon nanotube, and a nanoparticle.

7. The method for producing a radioactive zirconium complex according to any one of claims 1 to 6, wherein the reactive atomic group to be linked to the targeting agent includes an azido group, an alkynyl group, a diene or a dienophile.

8. The method for producing a radioactive zirconium complex according to any one of claims 1 to 7,

wherein the radioactive zirconium ion is coordinated to the ligand compound using the ligand compound having the reactive atomic group to be linked to the targeting agent, and then

the reactive atomic group is reacted with the targeting agent.