In one aspect, there is provided the use of a nanoparticle or nanoparticle aggregate to prepare a pharmaceutical composition for altering or destroying target cells in an animal when said cells are exposed to ionizing radiation, wherein the nanoparticle or nanoparticle aggregate consists of a metal oxide, wherein the density of said nanoparticle or the density of said nanoparticle aggregate is of at least 7 g/cm^3 and wherein the nanoparticle or nanoparticle aggregate is covered with a biocompatible coating allowing the nanoparticle stability between pH 6.5 and 7.5 in a physiological fluid.

In another aspect, there is provided a pharmaceutical composition when used for altering or destroying target cells in an animal when said cells are exposed to ionizing radiations, wherein said pharmaceutical composition comprises a nanoparticle or nanoparticle aggregate and a pharmaceutically acceptable excipient, wherein the nanoparticle or nanoparticle aggregate consists of a metal oxide, wherein the density of said nanoparticle or the density of said nanoparticle aggregate is of at least 7 g/cm^3, and wherein the nanoparticle or nanoparticle aggregate is covered with a biocompatible coating allowing the nanoparticle stability between pH 6.5 and 7.5 in a physiological fluid.

In another aspect, there is provided a pharmaceutical composition when used for detecting or visualizing and then altering or destroying target cells in an animal when said cells are exposed to ionizing radiation, wherein said pharmaceutical composition comprises a nanoparticle or nanoparticle aggregate and a pharmaceutically acceptable excipient, wherein the nanoparticle or nanoparticle aggregate consists of a metal oxide, wherein the density of said nanoparticle or the density of said nanoparticle aggregate is of at least 7 g/cm^3 and wherein the nanoparticle or nanoparticle aggregate is covered with a biocompatible coating allowing the nanoparticle stability between pH 6.5 and 7.5 in a physiological fluid.

CLAIMS

1. Use of a nanoparticle or nanoparticle aggregate to prepare a pharmaceutical composition intended to alter or destroy target cells in an animal when said cells are exposed to ionizing radiations, wherein the nanoparticle is made of an oxide (M_xO_y), the density of said oxide being of at least 7 g/cm^3 and wherein the nanoparticle or nanoparticle aggregate is covered with a biocompatible coating allowing the nanoparticle stability between pH 6.5 and 7.5 in a physiological fluid.

2. Use according to claim 1, wherein the oxide is selected from the group consisting of CeO_2, Nd_2O_3, Sm_2O_3, Eu_2O_3, Gd_2O_3, Tb_2O_3, Dy_2O_3, Ho_2O_3, Er_2O_3, Tm_2O_3, Yb_2O_3, Lu_2O_3, HfO_2, TaO_2, Ta_2O_5, WO_2, WO_3, ReO_2, OsO_2, IrO_2, PtO, PtO_2, HgO, Hg_2O, Tl_2O_3, PbO, Pb_2O_3, Pb_3O_4, PbO_2, PoO_2, Bi_2O_3, NbO, RuO_2, Rh_2O_3, RhO_2, PdO, Ag_2O, AgO, CdO, In_2O_3.

3. Use according to claim 2, wherein the oxide is HfO_2.

4. Use according to any one of claims 1 to 3, wherein the size of the nanoparticle or nanoparticle aggregate is between around 10 and 200 nm.

5. Use according to any one of claims 1 to 4, wherein said ionizing radiations are selected in the group consisting of X-Rays, γ-Rays, electron beams and radioisotope emissions.

6. Use according to any one of claims 1 to 5, wherein the ionizing radiations are of about 2 KeV to about 25 000 KeV.

7. Use according to claim 6, wherein the ionizing radiations are of about 2 KeV to 6000 KeV.

8. Use according to claim 6, wherein the ionizing radiations are of about 2 KeV to 1500 KeV.

9. Use according to any one of claims 1 to 8, wherein the nanoparticle is made of an inorganic material having an effective atomic number (Z_{eff}) of at least 50.

10. Use according to any one of claims 1 to 9, wherein the nanoparticle is essentially spherical in shape.

11. Use according to any one of claims 1 to 10, wherein target cells are selected in the group consisting of benign cells, pre-malignant cells and malignant cells.

12. Use according to claim 11, wherein said malignant cells are cells from a tumor selected in the group consisting of a haematological tumor and a solid tumor.

13. Use according to any one of claims 1 to 12, wherein the pharmaceutical composition further comprises an additional therapeutic compound, distinct from a nanoparticle or nanoparticle aggregate, intended to treat cancer.

14. Use according to any one of claims 1 to 13, wherein said animal is a human.

15. Pharmaceutical composition intended to alter or destroy target cells in a mammal when said cells are exposed to ionizing radiations, said pharmaceutical composition comprising a nanoparticle or nanoparticle aggregate and a pharmaceutically acceptable excipient, wherein the nanoparticle is made of an oxide (M_xO_y), the density of said oxide being of at least 7 g/cm^3, and the nanoparticle or nanoparticle aggregate is covered with a biocompatible coating allowing the nanoparticle stability between pH 6.5 and 7.5 in a physiological fluid.

CLAIMS

1. Use of a nanoparticle or nanoparticle aggregate to prepare a pharmaceutical composition for altering or destroying target cells in an animal when said cells are exposed to ionizing radiation, wherein the nanoparticle or nanoparticle aggregate consists of a metal oxide, wherein the density of said nanoparticle or the density of said nanoparticle aggregate is of at least 7 g/cm^3 and wherein the nanoparticle or nanoparticle aggregate is covered with a biocompatible coating allowing the nanoparticle stability between pH 6.5 and 7.5 in a physiological fluid.

2. Use according to claim 1, wherein the metal oxide is selected from the group consisting of CeO_2, Nd_2O_3, Sm_2O_3, Eu_2O_3, Gd_2O_3, Tb_2O_3, Dy_2O_3, Ho_2O_3, Er_2O_3, Tm_2O_3, Yb_2O_3, Lu_2O_3, HfO_2, TaO_2, Ta_2O_5, WO_2, WO_3, ReO_2, OsO_2, IrO_2, PtO, PtO_2, HgO, Hg_2O, Tl_2O_3, PbO, Pb_2O_3, Pb_3O_4, PbO_2, PoO_2, Bi_2O_3, NbO, RuO_2, Rh_2O_3, RhO_2, PdO, Ag_2O, AgO, CdO, In_2O_3.

3. Use according to claim 2, wherein the metal oxide is HfO_2.

4. Use according to any one of claims 1 to 3, wherein the size of the nanoparticle or nanoparticle aggregate is between around 10 and 200 nm.

5. Use according to any one of claims 1 to 4, wherein said ionizing radiations are selected in the group consisting of X-Rays, γ-Rays, electron beams and radioisotope emissions.

6. Use according to any one of claims 1 to 5, wherein the ionizing radiation is of about 2 KeV to about 25 000 KeV.

7. Use according to claim 6, wherein the ionizing radiation is of about 2 KeV to 6000 KeV.

8. Use according to claim 6, wherein the ionizing radiation is of about 2 KeV to 1500 KeV.

9. Use according to any one of claims 1 to 8, wherein the nanoparticle or nanoparticle aggregate consists of a metal oxide having an effective atomic number (Z_{eff}) of at least 50.

10. Use according to any one of claims 1 to 9, wherein the nanoparticle or nanoparticle aggregate is essentially spherical in shape.

11. Use according to any one of claims 1 to 10, wherein target cells are selected in the group consisting of benign cells, pre-malignant cells and malignant cells.

12. Use according to claim 11, wherein said malignant cells are cells from a tumor selected in the group consisting of a haematological tumor and a solid tumor.

13. Use according to any one of claims 1 to 12, wherein the pharmaceutical composition further comprises an additional therapeutic compound, distinct from a nanoparticle or nanoparticle aggregate, intended to treat cancer.

14. Use according to any one of claims 1 to 13, wherein said animal is a human.

15. Pharmaceutical composition when used for altering or destroying target cells in an animal when said cells are exposed to ionizing radiations, wherein said pharmaceutical composition comprises a nanoparticle or nanoparticle aggregate and a pharmaceutically acceptable excipient, wherein the nanoparticle or nanoparticle aggregate consists of a metal oxide, wherein the density of said nanoparticle or the density of said nanoparticle aggregate is of at least 7 g/cm^3, and wherein the nanoparticle or nanoparticle aggregate is covered with a biocompatible coating allowing the nanoparticle stability between pH 6.5 and 7.5 in a physiological fluid.

16. Pharmaceutical composition when used for detecting or visualizing and then altering or destroying target cells in an animal when said cells are exposed to ionizing radiation, wherein said pharmaceutical composition comprises a nanoparticle or nanoparticle aggregate and a pharmaceutically acceptable excipient, wherein the nanoparticle or nanoparticle aggregate consists of a metal oxide, wherein the density of said nanoparticle or the density of said nanoparticle aggregate is of at least 7 g/cm^3, and wherein the nanoparticle or nanoparticle aggregate is covered with a biocompatible coating allowing the nanoparticle stability between pH 6.5 and 7.5 in a physiological fluid.