Claims

[Claim 1] A composition comprising:

a photothermal agent, and one or more core particles,

wherein the photothermal agent and the core particles are encapsulated in a nanoparticle made from a biodegradable material.

[Claim 2] The composition of claim 1, wherein the core particles are solid particles, optionally the metal particles are Fe_3O_4 particles.

[Claim 3] The composition of claim 1 or 2, wherein the core particles are surface-modified for the attachment of the photothermal agent, optionally the core particles are modified on the surface by oleic acid molecules.

[Claim 4] The composition of any one of claims 1-3, wherein the core particles have a diameter of about 10 nm to about 40 nm.

[Claim 5] The composition of any one of claims 1-4, wherein the composition comprises about 1 to about 10 core particles.

[Claim 6] The composition of any one of claims 1-5, wherein the photothermal agent is selected from the group consisting indocyanine green (ICG), polydopamine, polyaniline (PANI), and polypyrrole (PPY).

[Claim 7] The composition of any one of claims 1-6, further comprising a therapeutic agent, wherein the therapeutic agent is encapsulated in the nanoparticle, optionally the therapeutic agent is an anti-cancer therapeutic agent.

[Claim 8] The composition of any one of claims 1-7, wherein the composition further comprises a tumor-targeting molecule attached to the surface of the nanoparticle, optionally the tumor-targeting molecule is an antibody, or antigen-binding fragment thereof, that binds to a tumor-specific antigen.

[Claim 9] The composition of any one of claims 1-8, wherein the diameter of the nanoparticle is about 70 nm to about 120 nm.

[Claim 10] A method of producing the composition of any of claims 1-9,

wherein the method comprises:

(a) contacting one or more core particles with the photothermal agent, thereby attaching the photothermal agent to the surface of the core particles;

(b) preparing a double emulsion comprising the biodegradable material; and

(c) contacting the product of step (a) with the double emulsion prepared in step (b), thereby producing the nanoparticles encapsulating the core particles; thereby producing the composition.

[Claim 11] The method of claim 10, wherein the biodegradable material is poly (lactic-co-glycolic acid)(PLGA).

[Claim 12] The method of claim 10 or 11, wherein the double emulsion further comprises polyvinyl alcohol (PVA).

[Claim 13] Use of the composition of any one of claims 1-9 in the manufacture of an agent for imaging a tumor tissue in a subject *in vivo*, wherein:

(a) an amount of the composition of any one of claims 1-9 is to be administered to the subject;

(b) the photothermal agent of the composition is to be excited; and

(c) the emitted fluorescent signals is to be detected,

thereby imaging the tumor tissue.

[Claim 14] Use of the composition of any one of claims 1-9 in the manufacture of an agent for diagnosing a tumor in a subject, wherein:

(a) an amount of the composition of any one of claims 1-9 is to be administered to the subject;

(b) the photothermal agent of the composition is to be excited; and

(c) the presence or absence of emitted fluorescent signals is to be detected,

thereby diagnosing the tumor.

[Claim 15] Use of the composition of any one of claims 1-9 in the manufacture of a medicament for treating a subject having tumor, wherein:

(a) an amount of the composition of any one of claims 1-9 is to be administered to the subject;

(b) the photothermal agent of the composition is to be excited, thereby increasing the temperature of the tumor cells that has internalized the composition and damaging the tumor cells,

thereby treating the subject having the tumor.

[Claim 16] The use of any one of claims 13-15, wherein the tumor is a solid tumor, optionally the tumor is lung cancer.

[Claim 17] The use of any one of claims 13-16, wherein the photothermal agent is

excited using a near-infrared (NIR) light.

[Claim 18] The use of any one of claims 13-17, wherein the photothermal agent is degraded after emitting heat.

[Claim 19] The use of any one of claims 13-18, wherein step (b) comprises heating the tumor cells at least once, optionally the tumor cells are heated to about 40 °C to about 45 °C.

[Claim 20] Use of the composition of any one of claims 1-9 in the manufacture of an agent for evaluating a therapeutic effect in a subject undergoing treatment with one or more cancer therapy, wherein:

(a) an amount of the composition of any one of claims 1-9 is to be administered to the subject;

(b) a tumor area is to be imaged and the tumor size is to be determined;

(c) the imaging and the determining of the tumor size is to be repeated at a later time point; and

(d) the therapeutic effect is to be evaluated based on the tumor size from the different time points;

thereby evaluating the therapeutic effect in the subject.