CLAIMS

1. A pharmaceutical composition comprising elemene, an oil for injection and a protein carrier.

2. The pharmaceutical composition according to claim 1, wherein the pharmaceutical composition is in the form of particles, and the particle size of the particles is less than 180 nm, preferably 50-180 nm; more preferably 70-170 nm; most preferably 70-150 nm.

3. The pharmaceutical composition according to claim 1, wherein the elemene is selected from one or more of α-elemene, β-elemene, γ-elemene and δ-elemene; preferably the elemene is β-elemene;

preferably, the protein carrier is albumin, and the albumin is selected from one or both of human serum albumin and bovine serum albumin; more preferably, the protein carrier is human serum albumin;

preferably, the oil for injection is one or more of soybean oil, safflower oil, cottonseed oil, corn oil, sunflower oil, peanut oil, olive oil, sesame oil, camellia oil, medium and long chain fatty glyceride or medium chain triglyceride.

4. The pharmaceutical composition according to claim 1, wherein the weight ratio of the albumin carrier to the elemene is 0.5-20;

preferably, the weight ratio of the albumin carrier to the elemene is 0.5-10;

preferably, the weight ratio of the oil for injection and the elemene is 0.35-10;

preferably, the weight ratio of the oil for injection and the elemene is 0.5-10.

5. The pharmaceutical composition according to any one of claims 1-4, further comprising a lyoprotectant;

preferably, the lyoprotectant is selected from one or more of glucose, sucrose, maltose, lactose, mannose, trehalose, glycine and dextran; more preferably, the lyoprotectant is trehalose or sucrose;

preferably the ratio of the weight of the lyoprotectant to the volume of the solution of the pharmaceutical composition is 3:100-20:100 g/mL.

6. The pharmaceutical composition according to any one of claims 1-5, further comprising one or more of isoosmotic adjusting agent, antioxidant, preservative, and pH regulator;

preferably, the isoosmotic adjusting agent is one or more of glycerin, sorbitol, mannitol or glucose;

preferably, the pH regulator is one or more of sodium hydroxide, sodium citrate, citric acid, phosphoric acid, acetic acid or hydrochloric acid;

preferably, the preservative is selected from one or more of hydroxybenzene alkyl esters, benzoic acid, sodium benzoate, sorbic acid, chlorhexidine acetate, benzalkonium bromide;

preferably, the antioxidant is selected from one or more of sodium sulfite, sodium bisulfite, sodium metabisulfite, sodium thiosulfate, ascorbic acid, butylated hydroxyanisole, 2,6-di-tert-butylated hydroxytoluene, and vitamin E.

7. The pharmaceutical composition according to any one of claims 1-6, wherein no organic solvent is included during preparation process thereof.

8. The pharmaceutical composition according to claim 7, wherein the pharmaceutical composition is prepared in the form of particles, and the particle size of the particles is less than 180 nm; preferably the particle size of the particles is 70-150 nm.

9. The pharmaceutical composition according to claim 7 or 8, wherein in the pharmaceutical composition, the weight ratio of the soybean oil to the elemene is about 0.35-3; the weight ratio of the human serum albumin to the elemene is about 0.5-20;

preferably, in the pharmaceutical composition, the weight ratio of the soybean oil to the elemene is about 0.5-3; the weight ratio of the human serum albumin to the elemene is about 0.5-2.5;

preferably, in the pharmaceutical composition, the weight ratio of the soybean oil to the elemene is about 0.35-1.5, more preferably 0.35-0.75; the weight ratio of the human serum albumin to the elemene is about 1.5-10;

more preferably the weight ratio of the soybean oil to the elemene is about 0.5; the weight ratio of the human serum albumin to the elemene is about 1.5;

more preferably the weight ratio of the soybean oil to the elemene is about 0.75; the weight ratio of the human serum albumin to the elemene is about 5;

more preferably the weight ratio of the soybean oil to the elemene is about 1.5; the weight ratio of the human serum albumin to the elemene is about 3-5.

10. The pharmaceutical composition according to any one of claims 1-9, wherein organic solvent is included during preparation process thereof;

preferably the organic solvent is selected from one or more of chloroform, dichloromethane, tertiary butanol, isopropanol, ethyl acetate, ethanol, tetrahydrofuran, dioxane, acetonitrile, acetone, dimethyl sulfoxide, dimethylformamide, and methylpyrrolidone;

preferably the organic solvent is a mixed solvent of dichloromethane and ethanol; preferably the volume ratio of dichloromethane to ethanol is 1:1-8; more preferably the volume ratio of dichloromethane to ethanol is 1:4.

11. The pharmaceutical composition according to claim 10, wherein the particle size of the particles is about 70-150 nm;

preferably, in the pharmaceutical composition, the weight ratio of the soybean oil to the elemene is about 2.4-10; the weight ratio of the human serum albumin to the elemene is about 0.5-10;

more preferably the weight ratio of the soybean oil to the elemene is about 2.4; the weight ratio of the human serum albumin to the elemene is about 3.

12. A method for preparing the pharmaceutical composition of any one of claims 1-11, comprising the steps of:

(1) mixing elemene and an oil for injection evenly, optionally adding an organic solvent, to obtain a solution of the elemene and the oil for injection; dissolving a protein carrier in water to obtain a protein carrier solution;

(2) mixing the two solutions obtained in step (1) to form an emulsion;

(3) homogenizing the emulsion in step (2) under a high pressure, and optionally evaporating the emulsion under a reduced pressure to remove the organic solvent, to obtain a nanoparticle solution;

preferably, the organic solvent is used in step (1), preferably dissolving the elemene in the organic solvent and then mixing with the oil for injection; more preferably, the oil for injection is soybean oil, the albumin carrier is human serum albumin; the weight ratio of the soybean oil to the elemene is about 2.4-10; the weight ratio of the human serum albumin to the elemene is about 0.5-10;

preferably, further comprising a step of lyophilizing the obtained solution of protein carrier nanoparticles;

preferably, in step (2), a shearing or ultrasonic method is used for mixing; and in step (3), a high-pressure homogenization or micro-jet homogenization method is used for homogenization.

13. Use of the pharmaceutical composition of any one of claims 1-11 in the preparation of a medicament for the prevention or treatment of cancer;

preferably the cancer is adrenocortical carcinoma, cryptogenic myeloid metaplasia, AIDS-related cancer, anal cancer, appendiceal cancer, astrocytoma, basal cell carcinoma , cholangiocarcinoma, bladder cancer, bone cancer, glioma, ependymoma, oligodendroglioma, meningioma, craniopharyngioma, hemangioblastoma, medulloblastoma, neuroectodermal tumor, visual pathway and hypothalamic glioma and glioblastoma, breast cancer, bronchial adenoma, carcinoid tumor, central nervous system lymphoma, cervical cancer, colon cancer, colorectal cancer, chronic myeloproliferative disorder, endometrial cancer, ependymoma, esophagus cancer, Ewing's tumor family, eye cancer, gallbladder cancer, gastrointestinal carcinoid tumor, gastrointestinal stromal tumor, germ cell carcinoma, gestational trophoblastic tumor, head and neck cancer, liver cancer, laryngeal cancer, leukemia, lip and oral cancer, lung cancer, lymphoma, medulloblastoma, melanoma, mesothelioma, metastatic neck squamous cell carcinoma, multiple endocrine neoplasia syndrome, myelodysplastic syndrome, myelodysplastic/myeloproliferative disease, carcinoma of nasal cavity and sinuses, nasopharyngeal cancer, neuroblastoma, neuroendocrine cancer, oropharyngeal cancer, brain tumor, bone metastasis cancer, gastric cancer, intestinal cancer, esophageal cancer, ovarian cancer, pancreatic cancer, breast cancer, skin cancer, parathyroid carcinoma, penile carcinoma, peritoneal cancer, pharyngeal carcinoma, pheochromocytoma, pineoblastoma and supratentorial primitive neuroectodermal tumor, pituitary tumor, pleuropulmonary blastoma, lymphoma, primary central nervous system lymphoma, pulmonary lymphangiomyomatosis, rectal cancer, kidney cancer, renal pelvis and ureter cancer, rhabdomyosarcoma, salivary gland cancer, skin cancer, small intestine cancer, squamous epithelial cell carcinoma, testicular cancer, throat cancer, thymoma and thymic carcinoma, thyroid cancer, urethral cancer, or vaginal cancer;

more preferably the cancer is lung cancer, liver cancer, esophageal cancer, nasopharyngeal cancer, brain tumor, bone metastasis cancer, gastric cancer, intestinal cancer, uterine cancer, cervical cancer, germ cell carcinoma, endometrial cancer, gestational trophoblastic tumor, breast cancer, skin cancer, lymphoma, leukemia, or malignant melanoma;

further preferably the cancer is brain tumor, more preferably glioma, brain stem glioma, cerebellar or cerebral astrocytoma, malignant glioma, ependymoma, oligodendroglioma,

meningioma, craniopharyngioma, hemangioblastoma, medulloblastoma, visual pathway and hypothalamic glioma or glioblastoma;

still further preferably the cerebellar or cerebral astrocytoma is fibrous cell astrocytoma or diffuse astrocytoma or anaplastic (malignant) astrocytoma.

14. A pharmaceutical formulation, comprising the pharmaceutical composition of any one of claims 1-11;

preferably the pharmaceutical formulation is a pharmaceutical formulation for intravenous administration, a pharmaceutical formulation for parenteral administration, a pharmaceutical formulation for gastrointestinal administration, a pharmaceutical formulation for respiratory administration, a pharmaceutical formulation for vaginal administration or other suitable pharmaceutical formulation; the pharmaceutical formulation for respiratory administration is aerosol;

preferably, the pharmaceutical formulation is a solid formulation, a liquid formulation or a gas formulation;

more preferably, the pharmaceutical formulation is a granule formulation, the particle size of the granule formulation is 70-150 nm, wherein in the composition, the weight ratio of the albumin to the elemene is 0.5-20, and the weight ratio of the oil for injection to the elemene is 0.35-10;

more preferably, the liquid formulation is a stable aqueous suspension reconstituted from a sterile lyophilized powder;

preferably, the liquid formulation is a liquid formulation for injection, comprising elemene and a pharmaceutically acceptable carrier, wherein the pharmaceutically acceptable carrier comprises albumin and soybean oil.

15. The pharmaceutical formulation according to claim 14, further comprising other drugs, including anticancer drugs;

preferably the anticancer drug comprises temozolomide, paclitaxel, docetaxel, taxane, gemcitabine, an anti-VEGF drug, or a PD-1 antibody drug;

more preferably the anti-VEGF drug comprises AVASTIN, ranibizumab, aflibercept, or conbercept;

more preferably the PD-1 antibody drug comprises nivolumab, pembrolizumab, toripalimab, sintilimab, cemiplimab, atezolizumab, avelumab, or durvalumab.

16. A sealed container comprising the pharmaceutical composition of any one of claims 1-11 or the pharmaceutical formulation of claim 14 or 15;

preferably the sealed container is a unit-dose container or a multi-dose container;

preferably the pharmaceutical composition is a liquid composition or a dry solid composition;

preferably the pharmaceutical composition is lyophilized;

preferably the pharmaceutical composition is sterile;

preferably the sealed container is a prefilled syringe.