prolong their blood half-life. Such strategy, which expressly relies on a probability-based approach, necessarily requires the association of the active agent with a targeting agent in order to achieve its successful accumulation on the target site by conferring said active agent an advantage over the inactive one. In addition, due to the quasi-concomitant injection, a specific design of the inactive carrier may be required depending on the intended use of the active composition.

WO2005/063305 relates to an assembly comprising a gas-filled microvesicle (with a size typically of at least 0.5 µm) and a component (with a size about below 100 nm) associated to said microvesicle. The resulting assembly is to be used as a pharmaceutically active component in diagnostically and/or therapeutically active formulations. The two components, i.e. the gas-filled microvesicle and the microvesicle associated component, are administered simultaneously typically for enhancing the imaging in the field of ultrasound contrast imaging, including targeted ultrasound imaging, ultrasound-mediated drug delivery and other imaging techniques.

As apparent from the prior art and despite of a long medical need, the improvement of the efficiency of compounds (including therapeutic, prophylactic as well as diagnostic compounds) which cannot be optimally used in patients due to their unacceptable toxicity or to their unfavorable pharmacokinetics parameters remains a concern.

SUMMARY

One aspect of the present invention relates to the use of a pharmaceutical composition comprising the combination of (i) at least one biocompatible nanoparticle and of (ii) at least one pharmaceutical compound, wherein the longest dimension of the biocompatible nanoparticle is between about 4 nm and about 500 nm, the absolute surface charge value of the biocompatible nanoparticle is of at least |10 mV|, and the Young modulus of the biocompatible nanoparticle is less than 100 kPa, in the manufacture of a medicament for use in a therapeutic, prophylactic or diagnostic method in a subject in need thereof, wherein the subject is to be administered with the at least one pharmaceutical compound and the at least one nanoparticle, and wherein said at least one nanoparticle is to be administered to the subject between more than 5 minutes and about 72 hours before or after the at least one pharmaceutical compound, and wherein the biocompatible nanoparticle is not used as such as a pharmaceutical compound.

DETAILED DESCRIPTION

The present invention now allows optimization of the efficiency of compound(s) of interest (herein also simply identified as "compound(s)") whatever its intended use in the context of therapy, prophylaxis or diagnostic. The composition herein described which is a combination of (i) at least one biocompatible nanoparticle and of (ii) at least one compound of interest, typically at least one pharmaceutical compound, optimize the at least one compound of interest's pharmacokinetic parameters, and, as a consequence, now renders possible the development of pharmaceutic compounds which could not have been developed otherwise due for example to their unacceptable toxicity. Typically, the biocompatible nanoparticle is not used as such as a pharmaceutical compound, i.e. as a therapeutic, prophylactic or diagnostic compound.

A typical composition of the invention (herein generally identified as "pharmaceutical composition") is a composition comprising the combination of (i) at least one

CLAIMS

1. Use of a pharmaceutical composition comprising the combination of (i) at least one biocompatible nanoparticle and of (ii) at least one pharmaceutical compound, wherein the longest dimension of the biocompatible nanoparticle is between about 4 nm and about 500 nm, the absolute surface charge value of the biocompatible nanoparticle is of at least |10 mV|, and the Young modulus of the biocompatible nanoparticle is less than 100 kPa, in the manufacture of a medicament for use in a therapeutic, prophylactic or diagnostic method in a subject in need thereof, wherein the subject is to be administered with the at least one pharmaceutical compound and the at least one nanoparticle, and wherein said at least one nanoparticle is to be administered to the subject between more than 5 minutes and about 72 hours before or after the at least one pharmaceutical compound, and wherein the biocompatible nanoparticle is not used as such as a pharmaceutical compound.

2. The use according to claim 1, wherein the nanoparticle has an absolute surface charge value of more than 10 mV, said charge being a negative charge.

3. The use according to claim 1 or 2, wherein the nanoparticle is an organic nanoparticle.

4. The use according to claim 3, wherein the nanoparticle is selected from a lipid-based nanoparticle, a protein-based nanoparticle, a polymer-based nanoparticle, a co-polymer-based nanoparticle, a carbon-based nanoparticle, and a virus-like nanoparticle.

5. The use according to anyone of claims 1 to 4, wherein the nanoparticle is further covered with a biocompatible coating.

6. The use according to anyone of claims 1 to 5, wherein the at least one biocompatible nanoparticle and the at least one pharmaceutical compound are to be administered in combination, to thereby maintain the therapeutic benefit of the pharmaceutical compound for a reduced toxicity, or increase the therapeutic benefit of the pharmaceutical

compound for an equivalent or reduced toxicity, for the subject, when compared to therapeutic benefit and toxicity induced by the standard therapeutic dose of said pharmaceutical compound in the absence of any nanoparticle.

7. The use according to anyone of claims 1 to 6, wherein the at least one biocompatible nanoparticle and the at least one pharmaceutical compound are to be administered in combination, to thereby allow a reduction of at least 10% of the administered pharmaceutical compound therapeutic dose when compared to the standard therapeutic dose of said pharmaceutical compound while maintaining the same therapeutic benefit for an equivalent toxicity or a reduced toxicity for the subject or while increasing the therapeutic benefit for an equivalent or reduced toxicity for the subject.

8. The use according to anyone of claims 1 to 7, wherein the at least one nanoparticle is cleared from the subject to whom it has been administered within one hour and six weeks after its administration to a subject in need of the pharmaceutical compound of interest referred to in claim 1.

9. The use according to anyone of claims 1 to 8, wherein the pharmaceutical compound is an organic compound selected from a biological compound, a small molecule targeted therapeutic, an oncolytic virus, or a cytotoxic compound.

10. The use according to claim 9, wherein the pharmaceutical compound is selected from an antibody, an oligonucleotide, or a synthesized peptide.

11. The use according to anyone of claims 1 to 10, wherein the pharmaceutical compound is an inorganic compound selected from a metallic nanoparticle, a metal oxide nanoparticle, a metal sulfide nanoparticle or any mixture thereof.

12. The use according to anyone of claims 1 to 11, wherein the pharmaceutical compound is encapsulated in a carrier.

13. The use according to anyone of claims 1 to 12, wherein the pharmaceutical compound is bound to a carrier.