CLAIMS

1. A method of preparing silica nanocapsules, the method comprising:

mixing a surfactant with water at a temperature that is above the gel-to-liquid transition temperature of the surfactant to form a mixture;

passing the mixture one or more times through at least one pore to obtain a dispersion of vesicles; and

adding a silica precursor to the dispersion of vesicles to form silica nanocapsules,

wherein the silica nanocapsules are substantially lens-shaped.

2. The method according to claim 1, wherein the step of adding a silica precursor to the dispersion of vesicles results in the silica precursor reacting with the vesicles to generate an organic solvent.

3. The method according to claim 2, wherein the organic solvent generated from the reaction between the silica precursor and the vesicles causes the shape of the vesicles to change from a substantially spherical shape to a substantially lens shape.

4. The method according to any one of claims 1-3, wherein the surfactant comprises a quaternary ammonium compound.

5. The method according to any one of claims 1-4, wherein the silica precursor comprises a silicon alkoxide.

6. The method according to any one of claims 1-5, wherein the surfactant comprises a quaternary ammonium compound selected from the group consisting of:

dimethyldioctadecylammonium bromide (DODAB); dimethyldioctadecylammonium chloride (DODAC); sulfate, phosphate or acetate salt of dimethyldioctadecylammonium (DODAX); dimethyldioctadecenylammonium bromide (DDAB);

dimethyldioctadecenylammonium chloride (DDAC); sulfate, phosphate, acetate salt of dimethyldioctadecenylammonium (DDAX); bromide, chloride, sulfate, phosphate or acetate salt of 1,2-dioleoyl-3-trimethylammonium propane (DOTAP); bromide, chloride, sulfate, phosphate or acetate salt of 1,2-dioleoyl-3-dimethylammonium propane (DODAP); bromide, chloride, sulfate, phosphate or acetate salt of N-[1-(2,3-dioleyloxy)propyl]-N,N,N-trimethylammonium (DOTMA), and combinations thereof; and wherein the silica precursor comprises a silicon alkoxide selected from the group consisting of: tetramethyl orthosilicate (TMOS), tetraethyl orthosilicate (TEOS), tetrapropyl orthosilicate (TPOS), tetrabutyl ortho silicate (TBOS) and combinations thereof.

7. The method according to any one of claims 1-6, wherein the at least one pore has a size of from 100 nm to 1300 nm.

8. The method according to any one of claims 1-7, wherein the step of passing the mixture one or more times through at least one pore comprises passing the mixture one or more times through the at least one pore to reach a dispersion of vesicles having a bluish hue.

9. The method according to any one of claims 1-8, wherein the step of adding a silica precursor to the dispersion of vesicles to form silica nanocapsules is carried out under ambient conditions.

10. The method according to any one of claims 1-9, wherein the step of adding a silica precursor comprises adding the silica precursor to the dispersion of vesicles in an amount such that the surfactant to silica precursor ratio is from 1:5 to 1:40.

11. The method according to any one of claims 1-10, further comprising non-thermally drying the silica nanocapsules to obtain a powdered form of silica nanocapsules.

12. The method according to any one of claims 1-11, further comprising a step of loading one or more types of cargo molecules into the silica nanocapsules, the step comprising:

subjecting the silica nanocapsules to a solution of the one or more types of cargo molecules; and

coagulating and/or filtrating the silica nanocapsules-containing solution to obtain the loaded silica nanocapsules.

13. The method according to any one of claims 1-11, further comprising a step of loading one or more types of cargo molecules into the silica nanocapsules, the step comprising:

mixing the one or more types of cargo molecules with the silica nanocapsules in the presence of a first organic solvent and a second organic solvent to obtain the loaded silica nanocapsules,

wherein the one or more types of cargo molecules is miscible with the first organic solvent, wherein the one or more types of cargo molecules is not miscible with the second organic solvent and wherein the first and second organic solvents are miscible with each other.

14. The method according to claim 13, wherein the step of mixing comprises mixing the one or more types of cargo molecules with the nanocapsules in the presence of a first organic solvent prior to adding the second organic solvent.

15. The method according to any one of claims 12-14, wherein the one or more types of cargo molecules comprises a hydrophilic active molecule.

16. The method according to any one of claims 1-15, wherein the method is substantially devoid of the addition of an organic solvent, the addition of a strong acid, the use of etching and the use of calcination, for the removal of a template used to form the silica nanocapsules.

17. A silica nanocapsule formed from a vesicle template, the silica nanocapsule comprising:

a porous silica shell; and

a substantially hollow core that is capable of carrying one or more types of cargo molecules in an amount that is at least 20% by weight of the silica nanocapsule,

wherein the silica nanocapsule is substantially lens-shaped.

18. The silica nanocapsule according to claim 17, further comprising one or more types of cargo molecules disposed in the substantially hollow core.

19. The silica nanocapsule according to claim 18, wherein the one or more types of cargo molecules comprises a hydrophilic active molecule.

20. The silica nanocapsule according to any one of claims 18-19, wherein the one or more types of cargo molecules are selected from the group consisting of therapeutic agents, diagnostic agents, pharmaceutical agents, cosmetic agents, cosmeceutical agents, nutraceutical agents and combinations thereof.

21. The silica nanocapsule according to any one of claims 17-20, wherein the silica nanocapsule has a silky feel to skin.

22. The silica nanocapsule according to any one of claims 17-21, wherein the silica nanocapsule comprises one or more of the following properties: biodegradable, biocompatible, non-toxic, hypoallergenic, non-immunogenic and more stable than a spherical microcapsule.