CLAIMS

1. A method of producing hollow inorganic microparticles each having a raspberry-like structure, wherein each of the hollow inorganic microparticles having the raspberry-like structure comprises a surface having mesopores and having hierarchical structures of nano-scale, submicron-scale, and micron-scale, the method comprising:

forming a suspension comprising hierarchical microparticles directly from mixing of two aqueous reactants, wherein the two aqueous reactants are aqueous solutions each containing a reactant for forming the hierarchical microparticles, wherein the hierarchical microparticles comprise $CaCO_3$ vaterite particles, wherein the aqueous solutions are a calcium chloride solution and a sodium carbonate solution;

adding a base;

adding a silica precursor, wherein the base is added prior to adding the silica precursor; and

removing the hierarchical microparticles with an acid to obtain the hollow inorganic microparticles each having the raspberry-like structure.

2. The method of claim 1, wherein forming the hierarchical microparticles comprises dissolving each of the reactant in an aqueous medium.

3. The method of claim 2, wherein the aqueous medium comprises water.

4. The method of any one of claims 1 to 3, wherein the base comprises ammonium hydroxide.

5. The method of any one of claims 1 to 4, wherein each of the hierarchical microparticles comprises an average diameter ranging from 1 µm to 100 µm.

6. The method of any one of claims 1 to 5, wherein the hierarchical microparticles are monodispersed or polydispersed.

7. The method of any one of claims 1 to 6, wherein the silica precursor is added without any alcohol.

8. The method of any one of claims 1 to 7, wherein adding the silica precursor comprises adding the silica precursor in a drop-wise manner.

9. The method of any one of claims 1 to 8, wherein the silica precursor comprises a silicon alkoxide, or a silicon derivative containing an organic or a polymerizable functional group.

10. The method of any one of claims 1 to 9, wherein the silica precursor comprises tetraethyl orthosilicate, vinyltrimethoxysilane, methyltrimethoxysilane, dimethyldimethoxysilane, (3-aminopropyl)trimethoxysilane, 3-glycidoxypropyltrimethoxysilane, or 3-methacryloxypropyltrimethoxysilane.

11. The method of any one of claims 1 to 10, wherein removing the hierarchical microparticles with an acid comprises:

contacting the hierarchical microparticles with the acid after adding the silica precursor, and

removing the acid.

12. The method of claim 11, further comprising another step of contacting the hierarchical microparticles with the acid to completely remove the hierarchical microparticles then removing the acid.

13. The method of claim 11 or 12, wherein removing the acid is carried out by centrifugation.

14. The method of any one of claims 1 to 13, wherein the acid comprises a mineral acid or an organic acid.

15. The method of claim 14, wherein the mineral acid comprises hydrochloric acid.

16. The method of claim 14 or 15, wherein the organic acid comprises ethylenediaminetetraacetic acid.

17. The method of any one of claims 1 to 16, wherein the acid has a concentration ranging from 0.02 M to 1 M.

18. The method of any one of claims 1 to 17, further comprising:

washing the hollow inorganic microparticles with water;

washing the hollow inorganic microparticles with an alcohol after washing the hollow inorganic microparticles with water; and

drying the hollow inorganic microparticles.

19. The method of claim 18, wherein the alcohol comprises ethanol.

20. A hollow inorganic microparticle having a raspberry-like structure produced according to the method of any one of claims 1 to 19, wherein the hollow inorganic microparticle having the raspberry-like structure comprises a surface having mesopores and having hierarchical structures of nano-scale, submicron-scale, and micron-scale.