WHAT IS CLAIMED IS:

1. A bone cement, the bone cement comprising:

a polyacrylate; and

an active pharmaceutical ingredient, wherein the active pharmaceutical ingredient is an antibiotic and is disposed within mesoporous silica nanoparticles;

wherein the mesoporous silica nanoparticle content is from about 6 to about 10% w/w; and

wherein the mesoporous silica nanoparticles form a diffusion network.

2. The bone cement of claim 1, wherein the polyacrylate comprises polymerized methyl methacrylate.

3. The bone cement of claim 2, wherein the polyacrylate is poly(methyl methacrylate).

4. The bone cement of any of the preceding claims, wherein the polyacrylate is a commercially available bone cement containing PMMA.

5. The bone cement of claim 4, wherein said polyacrylate is a member selected from the group consisting of methyl methacrylate copolymer and methyl methacrylate-styrene copolymer.

6. The bone cement of claim 4, wherein said bone cement comprises diffusion channels in a PMMA matrix to facilitate drug molecules diffusion.

7. The bone cement of claim 1, wherein the mesoporous silica nanoparticles are rod-like.

8. The bone cement of claim 1, wherein the active pharmaceutical ingredient is present in an amount about 0.1 to about 30% w/w.

9. The bone cement of claim 1, wherein the active pharmaceutical ingredient is present in an amount about 1 to about 20% w/w.

10. The bone cement of claim 1, wherein the active pharmaceutical ingredient is present in an amount about 4 to about 15% w/w.

11. The bone cement of claim **1**, wherein the antibiotic is selected from the group consisting of an aminoglycoside antibiotic, a glycopeptide antibiotic, a macrolide antibiotic, and a combination thereof.

12. The bone cement of claim **11**, wherein the antibiotic is selected from the group consisting of erythromycin, gentamicin, tobramycin, vancomycin, and a combination thereof.

13. The bone cement of claim **12**, wherein the antibiotic is gentamicin.

14. The bone cement of claim **12**, wherein the antibiotic is a combination of at least two compounds selected from the group of erythromycin, gentamicin, tobramycin, and vancomycin.

15. A method for preparing a bone cement, said method comprising:

impregnating a mesoporous silica nanoparticles with an active pharmaceutical agent to produce an impregnated mesoporous material, wherein the active pharmaceutical ingredient is an antibiotic;

mixing the impregnated mesoporous material with polyacrylate to produce an admixture, wherein the mesoporous silica nanoparticles content is from about 6 to about 10 % w/w;

adding a monomer to the admixture; and

polymerizing the admixture to form the bone cement.

16. A method for preparing a bone cement, the method comprising: impregnating mesoporous silica nanoparticles with an active pharmaceutical agent which is an antibiotic and a polyacrylate to produce an admixture, wherein the mesoporous silica nanoparticles content is from about 6 to about 10 % w/w;

adding a monomer to the admixture; and

polymerizing the admixture to form the bone cement.

17. A method for preventing or reducing postoperative osteomyelitis, the method comprising the step of: applying the bone cement of claim 1 to bone.

18. The bone cement of claim 1, wherein the active pharmaceutical ingredient is present in an amount about 0.2 to about 20 % w/w.

19. The bone cement of claim 1, wherein the active pharmaceutical ingredient is present in an amount about 0.5 to about 10 % w/w.

20. The bone cement of claim 1, wherein the active pharmaceutical ingredient is present in an amount about 1 to about 4 % w/w.

WHAT IS CLAIMED IS:

1. A bone cement, the bone cement comprising:

a polyacrylate; and

an active pharmaceutical ingredient, wherein the active pharmaceutical ingredient is an antibiotic and is disposed within ~~a mesoporous material.~~mesoporous silica nanoparticles;

wherein the mesoporous silica nanoparticle content is from about 6 to about 10% w/w; and

wherein the mesoporous silica nanoparticles form a diffusion network.

2. The bone cement of claim 1, wherein the polyacrylate comprises polymerized methyl methacrylate.

3. The bone cement of claim 2, wherein the polyacrylate is poly(methyl methacrylate).

4. The bone cement of any of the preceding claims, wherein the polyacrylate is a commercially available bone cement containing PMMA.

5. The bone cement of claim 4, wherein said polyacrylate is a member selected from the group consisting of ~~Simplex P, Smartset HV and Smartset GHV of Table 1.~~methyl methacrylate copolymer and methyl methacrylate-styrene copolymer.

6. The bone cement of claim 4, wherein said bone cement comprises diffusion channels in a PMMA matrix to facilitate drug molecules diffusion.

~~7. The bone cement of claim 1, wherein the mesoporous material is selected from the group consisting of mesoporous silica, alumina nanofibers, carbon nanotubes, titania nanotubes, hydroxyapatite nanorods, hydroxyapatite nanoparticles, and a combination thereof.~~

~~8. The bone cement of claim 7, wherein the mesoporous material is mesoporous silica.~~

7~~9~~. The bone cement of claim 1~~8~~, wherein the mesoporous silica nanoparticles are rod-like.~~has a particle size of about 0.1 μm to about 100 μm.~~

8~~10~~. The bone cement of claim 1~~9~~, wherein the active pharmaceutical ingredient is present in an amount about 0.1 to about 30% w/w.~~wherein the mesoporous silica has a particle size of about 0.1 μm to about 10 μm.~~

9~~11~~. The bone cement of claim 1~~10~~, wherein the active pharmaceutical ingredient is present in an amount about 1 to about 20% w/w.~~wherein the mesoporous silica has a particle size of about 0.1 μm to about 1 μm.~~

10~~12~~. The bone cement of claim 1~~8~~, wherein the active pharmaceutical ingredient is present in an amount about 4 to about 15% w/w.~~wherein the mesoporous silica comprises mesoporous silica nanoparticles.~~

~~13. The bone cement of any of the preceding claims, wherein the active pharmaceutical ingredient is an antibiotic.~~

11~~14~~. The bone cement of claim 1~~13~~, wherein the antibiotic is selected from the group consisting of an aminoglycoside antibiotic, a glycopeptide antibiotic, a macrolide antibiotic, and a combination thereof.

12~~15~~. The bone cement of claim 11~~14~~, wherein the antibiotic is selected from the group consisting of erythromycin, gentamicin, tobramycin, vancomycin, and a combination thereof.

13~~16~~. The bone cement of claim 12~~15~~, wherein the antibiotic is gentamicin.

14~~17~~. The bone cement of claim 12~~15~~, wherein the antibiotic is a combination of at least two compounds selected from the group of erythromycin, gentamicin, tobramycin, and vancomycin.

~~18. The bone cement of claim 17, wherein the antibiotic is a combination of gentamicin and vancomycin.~~

~~19. The bone cement of any of the preceding claims, wherein the bone cement additionally comprises an analgesic or an anti-inflammatory.~~

~~20. The bone cement of claim 19, wherein the anti-inflammatory is a non-steroidal anti-inflammatory.~~

~~21. The bone cement of claim 20, wherein the non-steroidal anti-inflammatory is selected from the group consisting of ibuprofen and indomethacin.~~

~~22. The bone cement of claim 1, wherein the bone cement comprises from about 1% to about 50% mesoporous material by weight.~~

~~23. The bone cement of claim 22, wherein the bone cement comprises from about 1% to about 20% mesoporous material by weight.~~

~~24. The bone cement of claim 23, wherein the bone cement comprises from about 4% to about 15% mesoporous material by weight.~~

~~25. The bone cement of claim 24, wherein the bone cement comprises from about 6% to about 10% mesoporous material by weight.~~

~~26. The bone cement of claim 1, wherein the bone cement comprises about 0.1% to about 30% active pharmaceutical agent by weight.~~

~~27. The bone cement of claim 26, wherein the bone cement comprises about 1% to about 20% active pharmaceutical agent.~~

~~28. The bone cement of claim 27, wherein the bone cement comprises about 1% to about 10% active pharmaceutical agent.~~

~~29. The bone cement of claim 28, wherein the bone cement comprises about 1% to about 7% active pharmaceutical agent by weight.~~

~~30. The bone cement of claim 29, wherein the bone cement comprises from about 1% to about 5% active pharmaceutical agent by weight.~~

~~31. The bone cement of any of the preceding claims wherein the bone cement comprises a material that is opaque to X-rays.~~

~~32. The bone cement of claim 31, wherein the material opaque to X-rays is selected from the group consisting of zirconium dioxide, barium sulfate, or a combination thereof.~~

~~33. The bone cement of claims 31 or 32, wherein the bone cement comprises about 10% to about 15% of the opaque material by weight.~~

~~34. The bone cement of any of the preceding claims, wherein compression strength of the bone cement is at least 70% to about 95% as high as compression strength of a control bone cement without the mesoporous material.~~

~~35. The bone cement of any of the preceding claims, wherein the compression strength is at least as high as the compression strength of the control bone cement without the mesoporous material.~~

~~36. The bone cement of any of the preceding claims, wherein bending modulus of the bone cement is at least 80% to about 95% as high as bending modulus of a control bone cement without the mesoporous material.~~

~~37. The bone cement of any of the preceding claims, wherein the bending modulus is at least as high as the bending modulus of the control bone cement without the mesoporous material.~~

~~38. The bone cement of any of the preceding claims, wherein detectible sustained release of the active pharmaceutical ingredient is maintained for at least 15 days to about 75 days.~~

~~39. The bone cement of any of the preceding claims, wherein at least 10% to about 70% of the active pharmaceutical ingredient is released from the bone cement within 80 days.~~

~~40. A method for preparing a bone cement, said method comprising:~~
~~impregnating a mesoporous material with an active pharmaceutical agent to produce an impregnated mesoporous material;~~
~~mixing the impregnated mesoporous material with polyacrylate to produce an admixture;~~
~~adding a monomer to the admixture; and~~
~~polymerizing the admixture to form the bone cement.~~

~~41. The method of claim 40, wherein the step of mixing the impregnated mesoporous material with polyacrylate comprises mixing a solid comprising the mesoporous material and a second solid comprising polyacrylate.~~

~~42. The method of claim 40, wherein the step of mixing the mesoporous material with the polyacrylate comprises dispersing the impregnated mesoporous material and the polyacrylate in a suspension.~~

~~43. The method of claim 40, wherein the polyacrylate is a commercially available bone cement containing PMMA.~~

~~44. The method of claim 40, wherein said polyacrylate is a member selected from the group consisting of Simplex P, Smartset HV and Smartset GHV of Table 1.~~

~~45. The method of claim 40, wherein said bone cement comprises diffusion channels in a PMMA matrix to facilitate drug molecules diffusion.~~

~~46. A method for preparing a bone cement, the method comprising:~~
~~impregnating a mesoporous material with an active pharmaceutical agent and a polyacrylate to produce an admixture;~~
~~adding a monomer to the admixture; and~~
~~polymerizing the admixture to form the bone cement.~~

~~47. The method of claim 46, wherein the polyacrylate is a commercially available bone cement containing PMMA.~~

~~48. The method of claim 46, wherein said polyacrylate is a member selected from the group consisting of Simplex P, Smartset HV and Smartset GHV of Table 1.~~

~~49. The method of claim 46, wherein said bone cement comprises diffusion channels in a PMMA matrix to facilitate drug molecules diffusion.~~

~~50. The method of any of claims 40-46, wherein the method further comprises a step of vacuum drying.~~

~~51. The method of claim 50, wherein the vacuum drying is at room temperature.~~

~~52. The method of any of claims 40-51, wherein the method further comprises a step of shaping the bone cement in a mold.~~

~~53. The method of claim 52, wherein the method further comprises adding a polymerization activator.~~

~~54. The method of claim 53, wherein the polymerization activator is added at about the same time as the monomer.~~

~~55. The method of claim 54, wherein before addition to the admixture, the polymerization activator is mixed with the monomer.~~

~~56. The method of claim 55, wherein before addition to the admixture, the polymerization activator is in a liquid solution.~~

~~57. The method of any of claims 53-56, wherein the polymerization activator is *N*,*N*-dimethyl-*p*-toludine.~~

~~58. The method of any of the preceding claims, wherein the method comprises a polymerization activator.~~

~~59. The method of claim 58, wherein the polymerization activator is *N*,*N*-dimethyl-*p*-toludine.~~

~~60. The method of claim 58 or 59, wherein the method comprises about 1% to about 4% of the polymerization activator by weight.~~

~~61. The method of claim 60, wherein the method comprises about 2.5% of the polymerization activator by weight.~~

~~62. The method of any of claims 58-61, wherein the polymerization activator is a liquid.~~

~~63. The method of any of claims 40-57, wherein the polyacrylate is a powder.~~

~~64. The method of claim 63, wherein the monomer is methyl methacrylate.~~

~~65. The method of any of the preceding claims, wherein the method comprises a polymerization initiator.~~

~~66. The method of claim 65, wherein the polymerization initiator is benzoyl peroxide.~~

~~67. The method of any of the preceding claims, wherein the method comprises about 0.8% to about 1.2% polymerization initiator by weight.~~

~~68. The method of claim 67, wherein the method comprises about 1.0% polymerization initiator by weight.~~

~~69. The method of any of claims 65-68, wherein the polymerization initiator is a powder.~~

~~70. The bone cement made by any of the claims 40-69.~~

~~71. A method for preventing or reducing postoperative osteomyelitis, the method comprising the step of: using the bone cement of any of claims 1-39.~~

~~72. Use of a bone cement, the bone cement comprising:~~
~~a polyacrylate; and~~
~~an active pharmaceutical ingredient, wherein the active pharmaceutical ingredient is disposed within the mesoporous material in the manufacture of a medicament for treating, preventing or reducing postoperative osteomyelitis.~~

~~73. Use of a bone cement of any of claims 1-39 in the manufacture of a medicament for treating, preventing or reducing postoperative osteomyelitis.~~

15. A method for preparing a bone cement, said method comprising:

impregnating a mesoporous silica nanoparticles with an active pharmaceutical agent to produce an impregnated mesoporous material, wherein the active pharmaceutical ingredient is an antibiotic;

mixing the impregnated mesoporous material with polyacrylate to produce an admixture, wherein the mesoporous silica nanoparticles content is from about 6 to about 10 % w/w;

adding a monomer to the admixture; and

polymerizing the admixture to form the bone cement.

16. A method for preparing a bone cement, the method comprising:
impregnating mesoporous silica nanoparticles with an active pharmaceutical agent which is an antibiotic and a polyacrylate to produce an admixture, wherein the mesoporous silica nanoparticles content is from about 6 to about 10 % w/w;

adding a monomer to the admixture; and

polymerizing the admixture to form the bone cement.

17. A method for preventing or reducing postoperative osteomyelitis, the method comprising the step of: applying the bone cement of claim 1 to bone.

18. The bone cement of claim 1, wherein the active pharmaceutical ingredient is present in an amount about 0.2 to about 20 % w/w.

19. The bone cement of claim 1, wherein the active pharmaceutical ingredient is present in an amount about 0.5 to about 10 % w/w.

20. The bone cement of claim 1, wherein the active pharmaceutical ingredient is present in an amount about 1 to about 4 % w/w.