CLAIMS

What is claimed is:

1. A biodegradable drug delivery composition comprising:

(a) a biodegradable triblock copolymer having the formula:

$$A_v\text{-}B_w\text{-}A_x$$

wherein A is a polyester and B is polyethylene glycol, wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and

(b) a biodegradable diblock copolymer having the formula:

$$C_y\text{-}A_z$$

wherein A is a polyester and C is an end-capped polyethylene glycol wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable CA diblock copolymer of (b) is 1:3 to 1:8 or 1:1 to 1:19 or 3:2 to 1:19 in said biodegradable drug composition; and (c) at least one pharmaceutically hydrophobic active principle.

2. The biodegradable drug delivery composition according to Claim 1, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine base or medroxyprogesterone acetate.

3. A biodegradable drug delivery composition comprising:

(a) a biodegradable triblock copolymer having the formula:

$$A_v\text{-}B_w\text{-}A_x$$

wherein A is a polyester and B is polyethylene glycol , wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x, v and x being ester repeat units and w being ethylene oxide repeat units and v=x or v≠x; and

(b) a biodegradable diblock copolymer having the formula:

$$C_y\text{-}A_z$$

wherein A is a polyester and C is an end-capped polyethylene glycol wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, y being the number of ethylene oxide repeat units and z the number of ester repeat units, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable CA diblock copolymer of (b) is 1: 3 to 1:8 or 1:1 to 1:19 or 3:2 to 1:19 in said biodegradable drug composition; and (c) at least one pharmaceutically hydrophobic active principle.

4. The biodegradable drug composition according to Claim 3, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine base or medroxyprogesterone acetate.

5. A biodegradable drug delivery composition comprising:

(a) a biodegradable triblock copolymer having the formula:

$$PLA_v\text{-}PEG_w\text{-}PLA_x$$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and

(b) a biodegradable diblock copolymer having the formula:

$$PEG_y\text{-}PLA_z$$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable diblock copolymer of (b) is 1:3 to 1:8 or 1:1 to 1:19 or 3:2 to 1:19 in said biodegradable drug composition and wherein the PEG in the diblock is end-capped; and (c) at least one pharmaceutically hydrophobic active principle

6. The biodegradable drug delivery composition according to Claim 5, wherein the at least one pharmaceutically hydrophobic active principle one of which is

risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate .

7. A biodegradable drug delivery composition, which comprises:

(a) a biodegradable triblock copolymer having the formula:

PLA_v-PEG_w-PLA_x

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and

(b) a biodegradable diblock having the formula:

PEG_y-PLA_z

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable diblock copolymer of (b) is 1:3 to 1:8 or 1:1 to 1:19 or 3:2 to 1:19 in said biodegradable drug composition and wherein the PEG in the diblock is end capped and (c) at least one pharmaceutically hydrophobic active principle.

8. The biodegradable drug delivery composition according to Claim 7, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate.

9. A biodegradable drug delivery composition, which comprises:

(a) a biodegradable triblock copolymer present in an amount of 3.0% to 45% (w%/w%) or 2% to 45% (w%/w%)of the total composition having the formula:

PLA_v-PEG_w-PLA_x

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273; and

(b) a biodegradable diblock copolymer present in an amount of 8.0% to 50% (w%/w%) of the total composition having the formula:

PEG_y-PLA_z

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable diblock copolymer of (b) is 1:3 to 1:8 or 1:1 to 1:19 or 3:2 to 1:19 in said biodegradable drug composition and wherein the PEG in the diblock is end capped and (c) at least one pharmaceutically hydrophobic active principle is present in an amount of 1% to 20% (w%/w%) or 1% to 40% (w%/w%) of the total composition.

10. The biodegradable drug delivery composition according to Claim 9, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate.

11. The biodegradable drug delivery compositions according to any one of Claims 1 to 10, wherein a lactic acid to ethylene oxide molar ratio in said composition is between 0.5 to 3.5 or between 0.5 to 2.5 or between 0.5 to 22.3 for the triblock copolymer and between 2 to 6 or between 0.8 to 13 or between 3 to 5 for the diblock copolymer.

12. The biodegradable drug delivery compositions according to any one of Claims 1 to 11, wherein said compositions are an injectable liquid that when inserted into the body of an animal or plant becomes a hardened implant.

13. A method for preparing the biodegradable drug delivery composition of the invention, said method comprising:

(i) dissolving in an organic solvent (a) a biodegradable ABA type block copolymer having the formula:

$$A_v\text{-}B_w\text{-}A_x$$

wherein A is a polyester and B is polyethylene glycol wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4

to 273 wherein v=x or v≠x; and (b) a biodegradable diblock copolymer having the formula:

$$C_y\text{-}A_z$$

wherein A is a polyester and C is an end-capped polyethylene glycol wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, in a ratio of 1: 3 to 1:8 or 1:1 to 1:19 or 3.2 to 1:19 to form a polymer mixture; and
(ii) adding at least one pharmaceutically hydrophobic active principle to said polymer mixture.

14. The method for preparing the biodegradable drug delivery compositions according to Claim 13, the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate to said polymer mixture.

15. A method for preparing the biodegradable drug delivery composition of the present invention said method comprising:(i) dissolving in an organic solvent (a) a biodegradable ABA type block copolymer having the formula:

$$A_v\text{-}B_w\text{-}A_x$$

wherein A is a polyester and B is polyethylene glycol wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 wherein v=x or v≠x; and (b) a biodegradable diblock copolymer having the formula:

$$C_y\text{-}A_z$$

wherein A is a polyester and C is an end-capped polyethylene glycol wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, in a ratio of 1: 3 to 1:8 or 1:1 to 1:19 or 3.2 to 1:19 to form a polymer mixture; (ii) adding at least one pharmaceutically hydrophobic active principle to said polymer mixture; and (iii) evaporating said solvent.

16. The method according to Claim 15, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate.

17. A method for preparing the biodegradable drug delivery composition of the present invention said method comprising:(i) dissolving in an organic solvent (a) a biodegradable ABA type block copolymer having the formula:

$$A_v\text{-}B_w\text{-}A_x$$

wherein A is a polyester and B is polyethylene glycol wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 , v and x being ester repeat units and w being ethylene oxide repeat units wherein v=x or v≠x; and (b) a biodegradable diblock copolymer having the formula:

$$C_y\text{-}A_z$$

wherein A is a polyester and C is an end-capped polyethylene glycol wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, y being the number of ethylene oxide repeat units and z the number of ester repeat units, in a ratio of 1: 3 to 1:8 or 1:1 to 1:19 or 3.2 to 1:19 to form a polymer mixture; (ii) adding at least one pharmaceutically hydrophobic active principle to said polymer mixture; and (iii) evaporating said solvent.

18. The method according to Claim 17, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate.

19. The method according to any one of Claims 13 to 18, the organic solvent is be present in an amount of 40% to 74% (w%/w%) or 30% to 70% (w%/w%) or 26% to 90% (w%/w%) of the total composition.

CLAIMS

What is claimed is:

1. A biodegradable drug delivery composition comprising:
   (a) a biodegradable triblock copolymer having the formula:

poly (lactic acid) $_v$-poly(ethylene glycol) $_w$-poly(lactic acid)$_x$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and

(b) a biodegradable diblock copolymer having the formula:

methoxy poly (ethylene glycol)$_y$-(polylactic acid)$_z$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable CA diblock copolymer of (b) is 3:2 to 1:19 in said biodegradable drug composition; and (c) at least one pharmaceutically hydrophobic active principle, wherein said at least one pharmaceutically active hydrophobic principle is present in the amount of 21.1% to 40% (wt%/wt%).

2. The biodegradable drug delivery composition according to Claim 1, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine base or medroxyprogesterone acetate.

3. A biodegradable drug delivery composition comprising:

   (a) a biodegradable triblock copolymer having the formula:

poly(lactic acid) $_v$-poly(ethylene glycol)$_w$-poly(lactic acid)$_x$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x, v and x being lactyl or lactoyl repeat units and w being ethylene glycol repeat units and v=x or v≠x; and

(b) a biodegradable diblock copolymer having the formula:

methoxy poly(ethylene glycol)$_y$-(polylactic acid)$_z$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, y being the number of ethylene glycol repeat units and z the number of lactyl or lactoyl repeat units, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable CA diblock copolymer of (b) is 3:2 to 1:19 in said biodegradable drug composition; and (c) at least one pharmaceutically hydrophobic active principle, wherein said at least one pharmaceutically active hydrophobic principle is present in the amount of 21.1% to 40% wt%/wt%.

4. The biodegradable drug composition according to Claim 3, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine base or medroxyprogesterone acetate.

5. A biodegradable drug delivery composition is, which comprises:

(a) a biodegradable triblock copolymer having the formula:

poly(lactic acid)$_v$-poly(ethylene glycol)$_w$-poly(lactic acid)$_x$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and

(b) a biodegradable diblock having the formula:

methoxy poly(ethylene glycol)$_y$-(polylactic acid)$_z$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable diblock copolymer of (b) is 3:2 to 1:19 in said biodegradable drug composition and (c) at least one pharmaceutically hydrophobic active principle, wherein said at least one hydrophobic active principle is a partial suspension.

6. The biodegradable drug delivery composition according to Claim 5, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate.

7. A biodegradable drug delivery composition, which comprises:

(a) a biodegradable triblock copolymer present in an amount of 3.0% to 45% (w%/w%) or 2% to 45% (w%/w%)of the total composition having the formula:

poly(lactic acid)$_v$-poly(ethylene glycol)$_w$-poly(lactic acid)$_x$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273; and

(b) a biodegradable diblock copolymer present in an amount of 8.0% to 50% (w%/w%) of the total composition having the formula:

methoxy poly(ethylene glycol)$_y$-(polylactic acid)$_z$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable diblock copolymer of (b) is 3:2 to 1:19 in said biodegradable drug composition (c) at least one pharmaceutically hydrophobic active principle which is in an

amount in an amount of 21.1% to 40% (w%/w%) of the total composition and an organic solvent.

8. The biodegradable drug delivery composition according to Claim 7, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate.

9. The biodegradable drug delivery compositions according to any one of Claims 1 to 7, wherein a lactic acid to ethylene oxide molar ratio in said composition is between 0.5 to 3.5 or between 0.5 to 2.5 or between 0.5 to 22.3 for the triblock copolymer and between 2 to 6 or between 0.8 to 13 or between 3 to 5 for the diblock copolymer.

10. The biodegradable drug delivery compositions according to any one of Claims 1 to 8, wherein said compositions are an injectable liquid that when inserted into the body of an animal or plant becomes a hardened implant.

11. A method for preparing the biodegradable drug delivery composition of the invention, said method comprising:

(i) dissolving in an organic solvent (a) a biodegradable ABA type block copolymer having the formula:

$$\text{poly(lactic acid)}_v\text{-poly(ethylene glycol)}_w\text{-poly(lactic acid)}_x$$

wherein A is a polyester and B is polyethylene glycol wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 wherein v=x or v≠x; and (b) a biodegradable diblock copolymer having the formula:

$$\text{methoxy poly(ethylene glycol)}_y\text{-(polylactic acid)}_z$$

wherein A is a polyester and C is an end-capped polyethylene glycol wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, in a ratio of 3.2 to 1:19 to form a polymer mixture; and
(ii) adding at least one pharmaceutically hydrophobic active principle to said polymer mixture, wherein said at least one pharmaceutically active hydrophobic principle is present in the amount of 21.1% to 40% (wt%/wt%).

12. The method for preparing the biodegradable drug delivery compositions according to Claim 11, the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate to said polymer mixture.

13. A method for preparing the biodegradable drug delivery composition of the present invention said method comprising:(i) dissolving in an organic solvent (a) a biodegradable ABA type block copolymer having the formula:

$$\text{poly(lactic acid)}_v\text{-poly(ethylene glycol)}_w\text{-poly(lactic acid)}_x$$

wherein A is a polyester and B is polyethylene glycol wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 wherein v=x or v≠x; and (b) a biodegradable diblock copolymer having the formula:

$$\text{methoxy poly(ethylene glycol)}_y\text{-(polylactic acid)}_z$$

wherein A is a polyester and C is an end-capped polyethylene glycol wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, in a ratio of 3.2 to 1:19 to form a polymer mixture; (ii) adding at least one pharmaceutically hydrophobic active principle to said polymer mixture, wherein said at least one pharmaceutically active hydrophobic principle is present in the amount of 21.1% to 40% (wt%/wt%).

; and (iii) evaporating said solvent.

14. The method according to Claim 13, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin, levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate.

15. A method for preparing the biodegradable drug delivery composition of the present invention said method comprising:(i) dissolving in an organic solvent (a) a biodegradable ABA type block copolymer having the formula:

$$\text{poly(lactic acid)}_v\text{-poly(ethylene glycol)}_w\text{-poly(lactic acid)}_x$$

wherein A is a polyester and B is polyethylene glycol wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 , v and x being ester repeat units and w being ethylene oxide repeat units wherein v=x or v≠x; and (b) a biodegradable diblock copolymer having the formula:

$$\text{methoxy poly(ethylene glycol)}_y\text{-(polylactic acid)}_z$$

wherein A is a polyester and C is an end-capped polyethylene glycol wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, y being the number of ethylene oxide repeat units and z the number of ester repeat units, in a ratio of 3.2 to 1:19 to form a polymer mixture; (ii) adding at least one pharmaceutically hydrophobic active principle to said polymer mixture, wherein said at least one hydrophobic active principle is a partial suspension; and (iii) evaporating said solvent.

16. The method according to Claim 15, wherein the at least one pharmaceutically hydrophobic active principle one of which is risperidone, ivermectin,

levonorgestrel, cyclosporine, progesterone, bupivacaine or medroxyprogesterone acetate.

17. The method according to any one of Claims 10 to 16, the organic solvent is be present in an amount of 40% to 74% (w%/w%) or 30% to 70% (w%/w%) or 26% to 90% (w%/w%) of the total composition.

18. A biodegradable drug delivery composition comprising:
(a) a biodegradable triblock copolymer having the formula:

poly(lactic acid)$_v$-poly(ethylene glycol)$_w$-poly(lactic acid)$_x$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and
(b) a biodegradable diblock copolymer having the formula:

methoxy poly(ethylene glycol)$_y$-(polylactic acid)$_z$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein the ratio of the biodegradable triblock copolymer of (a) and the biodegradable CA diblock copolymer of (b) is 2.0 to 4.0 in said biodegradable drug composition; and (c) at least one pharmaceutically hydrophobic active principle.

19. A biodegradable drug delivery composition comprising:
(a) a biodegradable triblock copolymer having the formula:

poly(lactic acid)$_v$-poly(ethylene glycol)$_w$-poly(lactic acid)$_x$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and
(b) a biodegradable diblock copolymer having the formula:

methoxy poly(ethylene glycol)$_y$-(polylactic acid)$_z$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein said copolymers are present in an amount of 2.5% to 17.5% (w%/w%) of the total composition.and (c) at least one pharmaceutically hydrophobic active principle.

20. A biodegradable drug delivery composition comprising:
(a) a biodegradable triblock copolymer having the formula:

poly(lactic acid)$_v$-poly(ethylene glycol)$_w$-poly(lactic acid)$_x$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and
(b) a biodegradable diblock copolymer having the formula:

methoxy poly(ethylene glycol)$_y$-(polylactic acid)$_z$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein said triblock copolymer is present in an amount of 1.2% to 2.9% (w%/w%) of the total composition and (c) at least one pharmaceutically hydrophobic active principle.

21. A biodegradable drug delivery composition comprising:
(a) a biodegradable triblock copolymer having the formula:

poly(lactic acid)$_v$-poly(ethylene glycol)$_w$-poly(lactic acid)$_x$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and

(b) a biodegradable diblock copolymer having the formula:

methoxy poly(ethylene glycol)$_y$-(polylactic acid)$_z$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein said diblock copolymer is present in an amount of 1.0% to 7.5% (w%/w%) of the total composition and (c) at least one pharmaceutically hydrophobic active principle.

22. A biodegradable drug delivery composition comprising:

(a) a biodegradable triblock copolymer having the formula:

poly(lactic acid)$_v$-poly(ethylene glycol)$_w$-poly(lactic acid)$_x$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and

(b) a biodegradable diblock copolymer having the formula:

methoxy poly(ethylene glycol)$_y$-(polylactic acid)$_z$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, further comprising an organic solvent, which is present in the amount of 75% to 87.5% (w%/w%) of the total composition and (c) at least one pharmaceutically hydrophobic active principle.

23. A biodegradable drug delivery composition comprising:

(a) a biodegradable triblock copolymer having the formula:

$$\text{poly(lactic acid)}_v\text{-poly(ethylene glycol)}_w\text{-poly(lactic acid)}_x$$

wherein v and x are the number of repeat units ranging from 24 to 682 and w is the number of repeat units ranging from 4 to 273 and v=x or v≠x; and

(b) a biodegradable diblock copolymer having the formula:

$$\text{methoxy poly(ethylene glycol)}_y\text{-(polylactic acid)}_z$$

wherein y and z are the number of repeat units y ranging from 3 to 45 and z ranging from 7 to 327, wherein a lactic acid to ethylene oxide molar ratio in said composition is between 3.5 to 4.0 for the triblock copolymer and between 2.3 to 5.0 for the diblock copolymer and (c) at least one pharmaceutically hydrophobic active principle..