providing a PLGA resin to a kneader and heating the PLGA resin to soften the PLGA resin to a viscosity of 10^2 to 10^7 Pa·s;

mixing powder of calcium phosphate fine particles with the softened PLGA resin by providing the powder into the kneader while rotating the blade of the kneader;

rotating the blade of the kneader with continuous force under the heating to knead the mixture so that thermal and mechanical energy is applied to the mixture to crush aggregates of the calcium phosphate fine particles, and thereby prepare a composite of the PLGA resin and the calcium phosphate fine particles dispersed therein;

cooling and solidifying the composite;

dissolving the composite with a solvent, and stirring for a predetermined time to prepare a spinning solution in which the PLGA resin is completely dissolved in the solvent and the calcium phosphate fine particles are dispersed without aggregation in the solvent in which the PLGA resin is dissolved; and

charging the spinning solution into a syringe of an electrospinning apparatus and applying high voltage to produce a biodegradable fiber in which the calcium phosphate fine particles are dispersed substantially uniformly in the biodegradable fiber.

[0016a]

In one aspect, there is provided a method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process, comprising

providing a PLGA resin to a kneader and heating the PLGA resin while rotating a blade of the kneader to soften the PLGA resin to a viscosity of $10^{3.2}$ to $10^{3.6}$Pa·s;

mixing powder of calcium phosphate fine particles with the softened PLGA resin by providing the powder into the kneader while rotating the blade;

rotating the blade of the kneader with continuous force under the heating to knead the mixture so that thermal and mechanical energy is applied to the mixture to produce a composite of the PLGA resin and the calcium phosphate fine particles dispersed in the PLGA resin;

cooling and solidifying the composite;

dissolving the composite with a solvent, and stirring the dissolved composite for a predetermined time to prepare a spinning solution in which the PLGA resin is completely dissolved by the solvent and the calcium phosphate fine particles are substantially uniformly dispersed in the solvent; and

charging the spinning solution into a syringe of an electrospinning apparatus and applying voltage to produce a biodegradable fiber in which the calcium phosphate fine particles are substantially uniformly dispersed.

[0017]

[Document Name] Claims

[Claim 1]

A method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process, comprising

providing a PLGA resin to a kneader and heating the PLGA resin while rotating a blade of the kneader to soften the PLGA resin to a viscosity of $10^{3.2}$ to $10^{3.6}$ Pa·s;

mixing powder of calcium phosphate fine particles with the softened PLGA resin by providing the powder into the kneader while rotating the blade;

rotating the blade of the kneader with continuous force under the heating to knead the mixture so that thermal and mechanical energy is applied to the mixture to produce a composite of the PLGA resin and the calcium phosphate fine particles dispersed in the PLGA resin;

cooling and solidifying the composite;

dissolving the composite with a solvent, and stirring the dissolved composite for a predetermined time to prepare a spinning solution in which the PLGA resin is completely dissolved by the solvent and the calcium phosphate fine particles are substantially uniformly dispersed in the solvent; and

charging the spinning solution into a syringe of an electrospinning apparatus and applying voltage to produce

a biodegradable fiber in which the calcium phosphate fine particles are substantially uniformly dispersed.

[Claim 2]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to claim 1, wherein the calcium phosphate fine particles are β-TCP fine particles.

[Claim 3]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 or 2, wherein the PLGA resin and the calcium phosphate fine particles are provided to the kneader in a ratio of from about 30 to 50wt% and from about 70 to 50wt% respectively.

[Claim 4]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 to 3, wherein after the PLGA resin is provided to the kneader and heated to be softened to the predetermined viscosity and kneaded for a predetermined time, the powder of calcium phosphate fine particles is provided to the kneaded PLGA resin in the kneader, and the PLGA resin and the calcium phosphate fine particles are kneaded in the kneader for a predetermined time at a temperature approximately equal to the temperature of the kneading of the PLGA resin.

[Claim 5]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 to 4, wherein the PLGA resin is a copolymer of PLA containing only the L-isomer of PLA and PGA.

[Claim 6]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 to 4, wherein the PLGA resin is a copolymer of PLA containing the L-isomer and the D-isomer of PLA in mixture and PGA.

[Claim 7]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 to 6, wherein the ratio of lactic acid and glycolic acid in the PLGA resin is approximately 85-50:15-50.

[Claim 8]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to claims 1 to 7, wherein the outer diameter of the β-TCP particles is about 0.5 to 4 μm.

[Claim 9]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 to 8, wherein the outer diameter of the biodegradable fiber is about 10 to 150 μm.

[Claim 10]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 to 9, wherein the bone-regeneration material including

the biodegradable fiber is in a cottonwool-like form with a bulk density of about 0.01 to 0.1 g/cm^3.

[Claim 11]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 to 10, wherein the molecular weight of the PLGA resin is about 60000 to 600000.

[Claim 12]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 to 11, wherein the kneader is a bench-top double arm kneader.

[Claim 13]

The method for producing a bone-regeneration material comprising biodegradable fiber using an electrospinning process according to any one of claims 1 to 12, wherein the kneader is a batch kneader.

[Claim 14]

The method for producing a bone-regeneration material comprising biodegradable fiber using an

electrospinning process according to any one of claims 1 to 13, wherein the kneader is a vacuum kneader.