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(54) Titre : MELANGES DE POLYMERES DE GLYCOLIDE ET DE LACTIDE ET DE CAPROLACTONE ET DE
POLYMERES DE CARBONATE DE TRIMETHYLENE, ET SUTURES RESORBABLES FABRIQUEES A PARTIR DE
CES MATERIAUX

(54) Title: BLENDS OF GLYCOLIDE AND/OR LACTIDE POLYMERS AND CAPROLACTONE AND/OR TRIMETHYLENE
CARBONATE POLYMERS AND ABSORBABLE SURGICAL DEVICES MADE THEREFROM

(57) Abrégé/Abstract:

Polymer blends of glycolide and/or lactide homopolymer and/or glycolide/lactide copolymer and polycaprolactone and/or polytrimethylene carbonate homopolymer or copolymers thereof and absorbable surgical devices manufactured therefrom having improved mechanical properties, such as improved impact resistance and improved cyclic flex, are disclosed.



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Polymer blends of glycolide and/or lactide
homopolymer and/or glycolide/lactide copolymer and
polycaprolactone and/or polytrimethylene carbonate
homopolymer or copolymers thereof and absorbable surgical
devices manufactured therefrom having improved mechanical
properties, such as improved impact resistance and improved
cyclic flex, are disclosed.

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1 BLENDS OF GLYCOLIDE AND/OR LACTIDE POLYMERS AND
CAPROLACTONE AND/OR TRIMETHYLENE CARBONATE POLYMERS
 AND ABSORBABLE SURGICAL DEVICES MADE THEREFROM

BACKGROUND OF THE INVENTION

10 This invention relates to glycolide and/or lactide
based polymer compositions and more particularly to polymer
compositions which are blends of a glycolide and/or lactide
homopolymer or glycolide/lactide copolymer and
polycaprolactone homopolymer and/or polytrimethylene
carbonate homopolymer and/or caprolactone or trimethylene
15 carbonate copolymer, said polymer compositions being
particularly useful in the manufacture of absorbable
surgical devices.

 Polymers and copolymers of, and surgical devices
made from, lactide and/or glycolide and/or related compounds
are well-known. See, e.g., U.S. Patent Nos. 2,668,162,
20 2,683,136, 2,703,316, 2,758,987, 3,225,766, 3,268,486,
3,268,487, 3,297,033, 3,422,181, 3,442,871, 3,463,158,
3,468,853, 3,531,561, 3,565,869, 3,597,449, 3,620,218,
3,626,948, 3,636,956, 3,736,646, 3,739,773, 3,772,420,
3,773,919, 3,781,349, 3,784,585, 3,792,010, 3,797,499,
25 3,839,297, 3,846,382, 3,867,190, 3,875,937, 3,878,284,
3,896,802, 3,902,497, 3,937,223, 3,982,543, 4,033,938,
4,045,418, 4,057,537, 4,060,089, 4,137,921, 4,157,437,
4,243,775, 4,246,904, 4,273,920, 4,275,813, 4,279,249,
30 4,300,565, and 4,744,365, U.K. Pat. or Appln. Nos. 779,291,
1,332,505, 1,414,600, and 2,102,827, D.K. Gilding et al.,

1 "Biodegradable polymers for use in surgery-polyglycolic/
poly (lactic acid) homo- and copolymers: 1," Polymer,
Volume 20, pages 1459-1464 (1979), and D.F. Williams
5 (ed.), Biocompatibility of Clinical Implant Materials,
Volume II, chapter 9: "Biodegradable Polymers" (1981).
Some of the foregoing documents listed mention or discuss
annealing, heat-treating, or post-treating surgical articles
containing the lactide/glycolide/related compound polymers
10 or copolymers. See, e.g., U.S. Patent Nos. 3,422,181,
3,626,948, 3,636,956, 3,772,420, 3,792,010, 3,797,499,
3,839,297, 3,878,284, 4,137,921, 4,157,437, 4,243,775,
4,300,565, U.K. Pat. or Appln. Nos. 1,332,505, 1,414,600,
and 2,102,827, and U.S. Patent Nos. 4,137,921, 4,157,437,
15 4,243,775, and 4,300,565.

In U.S. Patent No. 4,744,365 it was found that
certain two-phase compositions derived from lactide and
glycolide in which lactide moieties predominate, have a
remarkable and unexpected balance of desirable properties.
20 Those properties include lack of brittleness and the ability
to be injection molded and annealed. The properties of the
composition make it possible to injection mold surgical
devices (e.g., staples, clips) from the composition and to
anneal those devices to obtain devices having a remarkable
25 and unexpected balance of desirable properties. As compared
to a substantially amorphous, one-phase poly(lactide/glycolide)
device of a given composition, the annealed, two-phase
device of the same overall composition has a much higher
distortion temperature but essentially the same in vivo rate
30 of loss of tensile strength. Thus, the compositions of U.S.
Patent No. 4,744,365 make it possible to increase the

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1 resistance to thermal distortion of poly(lactide/glycolide)
surgical devices without adversely affecting their rate of
loss of tensile strength. More particularly, the
compositions of U.S. Patent No. 4,744,365 comprise a multi-
5 phase polymeric composition derived from lactide and
glycolide, the first phase having about 0 to about 25% m
glycolide moieties and about 75 to about 100% m lactide
moieties and the other phases having glycolide and lactide
moieties in amounts such that the composition overall has up
10 to 45% m glycolide moietites, wherein the first phase
constitutes at least 50% (and preferably not more than about
95%) by weight of the composition.

In addition to the afore-recited patents and other
documents which disclose polymers and copolymers of, and
15 surgical devices made from lactide and glycolide, other
patents disclose surgical devices prepared from copolymers
of lactide or glycolide and other monomers including
caprolactone or trimethylene carbonate. Such patents
include U.S. Patent No. 4,700,704, U.S. Patent No. 4,605,730
20 and U.S. Patent No. 4,643,734. More particularly, U.S.
Patent No. 4,605,730 and U.S. Patent No. 4,700,704 disclose
copolymers of epsilon-caprolactone and glycolide useful in
making surgical articles and particularly surgical sutures
having low Young's modulus. In addition to the afore-
25 recited patents, U.S. Patent No. 4,624,256 discloses the
utilization of high molecular weight caprolactone polymers
as coatings for surgical sutures, while U.S. Patent No.
4,429,080 discloses surgical articles manufactured from
triblock copolymers prepared from copolymerizing glycolide
30 with trimethylene carbonate.

1 SUMMARY OF THE INVENTION

It is one object of the present invention to provide novel polymer compositions useful for the manufacture of surgical devices.

5 It is another object of this invention to provide polymer compositions which are comprised of novel blends of two or more polymers.

It is still another object of the present invention to provide absorbable surgical devices having
10 improved mechanical properties which are manufactured from the novel polymer compositions of the invention.

These and other objects are accomplished herein by providing an absorbable polymeric composition, suitable for the manufacture of surgical devices, comprising a blend of:

15 (a) polymer selected from the group consisting of glycolide homopolymer, lactide homopolymer, a mixture of glycolide homopolymer and lactide homopolymer and glycolide/lactide copolymer; and

(b) from about 1 weight percent to about 50 weight
20 percent of a polymer selected from the group consisting of polycaprolactone homopolymer, polytrimethylene carbonate homopolymer, copolymers of caprolactone and lactide, copolymers of caprolactone and glycolide, copolymers of trimethylene carbonate and lactide, copolymers of
25 trimethylene carbonate and glycolide, copolymers of caprolactone, glycolide and lactide, copolymers of trimethylene carbonate, glycolide and lactide and mixtures thereof, based on the total weight of the blend.

Other objects of the invention are achieved herein
30 by providing absorbable surgical devices derived from the

1 afore-described polymer blend compositions of the present
invention.

DETAILED DESCRIPTION OF THE INVENTION

5 A bioabsorbable reinforced composite material
and method for the production thereof is known, wherein
a component of the composite material may comprise a
blend of homopolymers or copolymers of glycolide and
lactide and polycaprolactone, and/or polytrimethylene
10 carbonate.

 In accordance with the present invention, it has
now been found that absorbable surgical devices manufactured
from these blends comprised of glycolide homopolymer,
lactide homopolymer, glycolide/lactide copolymer or mixtures
15 thereof and polycaprolactone homopolymer, polytrimethylene
carbonate homopolymer and/or copolymers of caprolactone or
trimethylene carbonate and glycolide and/or lactide, wherein
the caprolactone or the trimethylene carbonate is the
predominant monomer, possess improved physical and
20 mechanical properties in comparison with surgical devices
derived from glycolide or lactide homopolymer or
glycolide/lactide copolymer alone.

 More particularly, surgical devices prepared from
the polymer blends of the present invention comprising
25 glycolide or lactide homopolymer or glycolide/lactide
copolymer and polycaprolactone or polytrimethylene carbonate
homopolymer and/or copolymers of caprolactone or
trimethylene carbonate and glycolide and/or lactide, wherein
the caprolactone or the trimethylene carbonate is the
30 predominant monomer (i.e. greater than 50 mole percent
preferably at least 80 mole percent), are found to exhibit

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1 improved impact resistance, improved crazing properties and improved cyclic flexibility, both when annealed and non-annealed.

5 The novel polymer compositions of the present invention are blends of at least two polymers one of which is polycaprolactone homopolymer or polytrimethylene carbonate homopolymer or copolymer of polycaprolactone and glycolide and/or lactide or copolymer of trimethylene carbonate and glycolide and/or lactide or a mixture thereof.

10 In particular, the novel blends of the present invention comprise polycaprolactone homopolymer or polytrimethylene carbonate homopolymer or copolymer of polycaprolactone and glycolide and/or lactide or copolymer of trimethylene carbonate and glycolide and/or lactide or
15 mixtures thereof and a polymer selected from a glycolide homopolymer, a blend of a glycolide homopolymer and a lactide homopolymer, a glycolide/lactide copolymer or mixtures thereof.

For the glycolide homopolymer and lactide
20 homopolymer or glycolide/lactide copolymer employed, the proportion of glycolide in relation to lactide in the composition can vary depending upon the physical properties desired. For example, if the proportion of lactide is too high, the absorption time of a surgical implant device
25 derived therefrom may be too long and if the glycolide proportion is too high, the breaking strength (tensile strength) retention upon implantation in the body of the device may be unacceptable. Typically acceptable results are achieved when up to about 50% glycolide, in relation to
30 the amount of lactide, is used. Thus, preferred copolymers

1 useful in the practice of the present invention are those
comprising about 18/82 glycolide/lactide (mole percent),
10/90 glycolide/lactide (mole percent) 35/65 glycolide/
lactide (mole percent) and 42/58 glycolide/lactide (mole
5 percent).

The glycolide homopolymers, lactide homopolymers
and glycolide/lactide copolymers employed in the blends of
the present invention are known materials and are readily
synthesized by known methods. Generally, the glycolide
10 and/or lactide homopolymer and glycolide/lactide copolymers
employed in the blends of the present invention have a
molecular weight such that they have an inherent viscosity
of from about 0.9 to about 2.0 dl/g and preferably about 1.0
to about 1.8 dl/g measured at 30°C at a concentration of
15 0.25 g/dl in chloroform or hexafluoroisopropanol (HFIP).
Particularly preferred glycolide/lactide copolymer for the
purposes of the present invention are the two-phase or
multi-phase compositions disclosed in U.S. Patent No.
4,744,365.

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The polycaprolactone homopolymers and copolymers
employed in polymer blends of the present invention are also
well known and commercially available materials. For the
purposes of the present invention, polycaprolactone
25 homopolymers or copolymers having an inherent viscosity of
from about 0.8 to about 2.5 dl/g measured at 30°C and a
concentration of 0.25 g/dl in chloroform or HFIP are
generally employed.

The polytrimethylene carbonate homopolymers and
30 copolymers used in the practice of the present invention are
also well known and commercially available materials. For

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1 purposes of the present invention polytrimethylene carbonate
homopolymers having an inherent viscosity of from about 0.8
to about 2.5 dl/g measured at 30°C and a concentration of
0.25 g/dl in chloroform or HFIP are generally used.

5 Copolymerization of caprolactone or trimethylene
carbonate with glycolide and/or lactide has been found to
facilitate handling of the caprolactone or trimethylene
carbonate, e.g., processing through and removal from
extrusion equipment.

10 The polymer blends of the present invention are
typically prepared by melt blending the components of the
blend. The glycolide and/or lactide homopolymer or mixture
thereof or the glycolide/lactide copolymer is used in the
blend in a major amount, that is, from about 50 to about 99
15 weight percent of the total weight of the blend, the
remainder, i.e. from about 1 to about 50 weight percent,
comprising polycaprolactone homopolymer and/or copolymer
and/or polytrimethylene carbonate homopolymer and/or
copolymer. Melt blending is typically carried out at a
20 temperature of 170°C to 200°C for a time sufficient to
liquify the components, the time being dependent on such
parameters as vessel, heat transfer properties, and presence
and extent of blending. Typically, melt time ranges from a
few minutes for small amounts of polymer to a couple of
25 hours for large quantities.

It has also been found herein that surgical
devices manufactured from the blends of the present
invention possess the excellent afore-described physical
properties whether or not annealed.

30 Whichever polymer blend of the present invention
is used, the absorbable surgical devices are made,

1 preferably, by injection molding the blend at temperatures
in the range of from about 300 to about 400°F at an
injection molding pressure of, for example, about 1,500 psi.
Typically, the feed for the injection molding apparatus is a
5 melt blend of the two polymers in pellet form. The polymers
should be quite dry when being injection molded in order to
avoid hydrolytic degradation during processing. After
molding, the surgical devices can be packaged and sterilized
by conventional procedures. It may be desirable to anneal
10 the devices to remove residual stresses and strains, to
stabilize the shape of the device, and to reduce or
eliminate defects in the piece. Annealing typically
comprises reheating the polymeric device to above its glass
transition temperature where chain mobility is greatest, and
15 then slowly and gradually cooling the device to avoid
reintroducing. Procedures, conditions and apparatus for
annealing polymeric structures are well known in the art.

A wide variety of absorbable surgical devices can
be manufactured from the polymer blends of the present
20 invention. These include fasteners, such as staples, clips
and the like and other implant devices, such as pins, bone
screws, or the like.

As expressed hereinbefore, the surgical devices of
the present invention exhibit excellent in vivo cyclic flex
25 performance, a mechanical property which is highly desired
in surgical devices and in particular, for example, in
surgical implant devices, such as surgical fastener/retainer
systems which, after implantation, are subject to a variety
of forces and often undergo repeated flexing.

30 Furthermore, surgical devices manufactured from
the novel polymer blends of the present invention exhibit

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1 improved impact resistance as well as improved crazing
resistance. Crazing may be defined as surface cracking of
the material as contrasted with impact resistance which is
more a measure of a material's tendency to allow crack
5 propagation. Crazing may be observed visually, such as for
example, a polymeric article which is flexed will evidence
crazing by fogging of an otherwise clear or transparent
material. In surgical applications, once a surgical article
crazes, although the article may continue to function for a
10 limited period, the article may not exhibit the desired
strength. Thus, a material with a more limited tendency to
craze when fabricated, for example, into a surgical implant
device such as a bone screw, would permit the bone screw to
be torqued to a greater extent without a likelihood that the
15 screw would craze and thereby become ineffective for its
intended purpose.

The examples below are illustrative of the blends
of the present invention and surgical devices derived
therefrom.

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Example 1

A copolymer of glycolide and lactide is prepared as follows:

5 Hydroxyacetic acid (glycolic acid) is heated under nitrogen to 180°C to remove impurities such as water. Pressure is then reduced and heating is continued for two hours to yield a prepolymer of polyglycolic acid, which is recovered and powdered.

10 The prepolymer is heated in the presence of Sb_2O_3 at 275°C under low pressure with an argon purge and stirring. The prepolymer cracks and glycolide is distilled over and recovered in a cold vacuum receiver. Preferably, the glycolide is purified by conventional techniques, such as distillation, crystallization, and sublimation.

15 L-lactide is used alone or in combination with a small amount of the DL racemer. L-lactide is purified by crystallization from toluene solution. The DL racemer, if used, is purified by crystallization from ethyl acetate.

20 A mixture of the purified glycolide (18 mole percent) and lactide (82 mole percent) is charged to a reactor under an argon blanket. A solution of stannous octoate catalyst in diethyl ether is added to give 0.02% w. of catalyst, based on the total weight of glycolide and lactide. The reactor is further purged with argon and held
25 at 5 psi while heating to 170°-175°C. Pressure and temperature are maintained for six hours.

The reaction product is isolated, comminuted, and treated to remove residual reactants. Any method capable of removing the unreacted monomers from the crude reaction
30 product may be used. A preferred purification procedure is as follows.

1 After comminution, the crude reaction product is
contacted with ethyl ether for about 72 hours in a Soxhlet-
type extractor to remove unreacted monomer. Typically, 4-
10% of the starting monomers remain unreacted, and the glass
5 transition temperature of the crude copolymer is
approximately 50°C. Removal of unreacted monomers raises
the glass transition temperature. As will be understood by
one skilled in the art, the composition of the copolymer may
differ slightly from the composition of the starting
10 monomeric mixture because the lactide and glycolide are not
of equal reactivity.

After the extraction period, the partially
purified copolymer is slowly heated under vacuum from
ambient temperature to 140°C over a period of about 48
15 hours. The slow rate of heating is desirable to prevent
melting (strictly speaking, flowing together) of the co-
polymer particles and to remove any water present.
Desirably, dry inert gas is used to purge the system, and
occasionally the heating step may require more than 48 hours
20 to reach the desired glass transition temperature. The
combination of slow heating and purging with dry gas removes
any residual solvent (ethyl ether) present, thereby raising
the glass transition temperature.

After removal of unreacted monomers (and of
25 solvent, if solvent extraction is used), the purified
copolymer is further dried if it was not dried enough in the
monomer removal step and, in any event, stored to keep it
dry.

Trimethylene carbonate is polymerized in a reactor
30 at 160°C with a stannous octoate catalyst. The
polytrimethylene carbonate so formed is melt blended with

1 the glycolide/lactide copolymer (18/82) described above in
the reactor at a temperature of 190°C and at a weight ratio
of 25:75. The blended polymer is extruded, ground,
5 extracted with ether, and dried in accordance with known
procedures.

Surgical devices fabricated from this blended
polymer exhibit excellent physical properties, including
good impact resistance, resistance to crazing and cyclic
flexibility.

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Example 2

1 A glycolide/lactide copolymer (18/82 mole ratio)
prepared as described in Example 1 is melt blended with a
polycaprolactone homopolymer at weight ratios of 85:15 and
5 80:20 in a reactor at a temperature of 190°C. The blended
polymer is extruded, ground, extracted with ether, and
dried, as are known in the art.

The melt blended polymers are injection molded at
a temperature of 130°C to 140°C at an injection molding
10 pressure, e.g., 1,500 to 1,750 psi, to form a series of test
plates measuring 2.2 inch x 2.7 inch x 0.070 inch. One
portion of the test plates are annealed at an annealing
temperature of about 85°C to 100°C for 12 to 16 hours to
remove internal stresses. A second portion of the test
15 plates are not annealed. Control test plates are also
injection molded from the glycolide/lactide copolymer
described in Example 1, none of which are annealed.

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Example 3

The test plates injection molded as described in Example 2 are tested for impact resistance using a standard dart impact tester. The test plates are designated as

5 follows:

Control: glycolide/lactide copolymer (18/82);
unannealed

Sample 1: glycolide/lactide copolymer (18/82) blended
with polycaprolactone at a weight ratio of
85:15; unannealed

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Sample 2: glycolide/lactide copolymer (18/82) blended
with polycaprolactone at a weight ratio of
85:15; annealed

Sample 3: glycolide/lactide copolymer (18/82) blended
with polycaprolactone at a weight ratio of
80:20; unannealed

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Sample 4: glycolide/lactide copolymer (18/82) blended
with polycaprolactone at a weight ratio of
80:20; annealed

The results of the impact tests are set forth in
the following Table I:

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TABLE I

Force (in-lb)	Control	Sample 1	Sample 2	Sample 3	Sample 4
10	4	4	4	4	3
20	6	4	4	4	3
25	30		6		
40				5	4

Mode of Failure: 1. No effect; 2. Slight fractures;
3. Indentation with some crazing;
4. Cracks at point of contact; 5. Hole
punched at point of contact; 6. Shattered.

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These results show that the polymeric blends of the present invention exhibit improved impact resistance as compared to a non-blended control, i.e., a glycolide/lactide copolymer without added polycaprolactone. In addition, the test plates for Samples 1-4 exhibit improved resistance to crazing. Improved cyclic flex performance is also to be expected.

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Example 4

1 A two-phase polymeric composition comprising
glycolide and lactide is prepared according to the procedure
described in U.S. Patent No. 4,744,365. A first monomer
5 mixture of glycolide and lactide at a mole ratio of 10:90 is
polymerized in the presence of a stannous octate catalyst
until the polymerization is substantially complete. To this
glycolide/lactide copolymer is added a second monomer
mixture consisting of additional glycolide, such mixture
10 being added in sufficient quantity that the final mole ratio
of the two-phase polymeric composition is 35:65 glycolide to
lactide. After the additional glycolide polymerizes with
the glycolide/lactide copolymer, the two-phase polymer
composition is ground, dried and ether extracted in
15 accordance with known procedures.

Polycaprolactone is combined with the two-phase
glycolide/lactide polymeric composition at mole ratios of
5:95 and 10:90, melt blended therewith at a temperature of
170°C to 200°C and the resulting blends are pelletized for
20 subsequent use as described below.

The pellets of melt blended polymer are injection
molded at a temperature of 130°C to 140°C at an injection
molding pressure, e.g., 1,500 to 1,750 psi, to form a series
of test plates measuring 2.2 inch x 2.7 inch x 0.070 inch.
25 Control test plates are also injection molded from the two-
phase glycolide/lactide polymeric compositions. One portion
of the test plates are annealed at an annealing temperature
of about 85°C to 100°C for 12 to 16 hours to remove internal
stresses. A second portion of the test plates are not
30 annealed.

1 The test plates are tested for impact resistance
using a standard falling dart impact tester. The test
plates are designated as follows:

5 Control 1: two-phase glycolide/lactide polymer (35/65);
 unannealed

 Control 2: two-phase glycolide/lactide polymer (35/65);
 annealed

 Sample 1: two-phase glycolide/lactide polymer (35/65)
 blended with polycaprolactone at a weight
 ratio of 95:5; unannealed

10 Sample 2: two-phase glycolide/lactide polymer (35/65)
 blended with polycaprolactone at a weight
 ratio of 95:5; annealed

 Sample 3: two-phase glycolide/lactide polymer (35/65)
 blended with polycaprolactone at a weight
 ratio of 90:10; unannealed

15 Sample 4: two-phase glycolide/lactide polymer (35/65)
 blended with polycaprolactone at a weight
 ratio of 90:10; annealed

 The results of the impact tests are set forth in
the following Table II:

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TABLE II

	Force (in-lb)	Control 1	Control 2	Sample 1	Sample 2	Sample 3	Sample 4
5	10	4 5	4				
	20	5	4 5	4	2 4 2	2	2
	30			5			
10	40	5 6	5 6		4	3	3
	50	5 6					
	60	6	6		4 4	3	3
15	80				4 4	3	3 3 3

These results show that the polymeric blends of the present invention exhibit improved impact resistance as compared to non-blended controls, i.e., glycolide/lactide polymers without added polycaprolactone. In addition, the test plates for Samples 1-4 exhibit improved resistance to crazing. Improved cyclic flex performance is also to be expected.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A polymer composition, useful in the production of improved absorbable surgical devices, said polymer composition comprising a blend of:

a) a polymer selected from the group consisting of glycolide homopolymer, lactide homopolymer, a mixture of glycolide homopolymer and lactide homopolymer, a glycolide/lactide copolymer and mixtures thereof; and

b) from about 1 to about 50 weight percent, based on the total weight of the blend, of a polymer selected from the group consisting of copolymers of caprolactone and lactide, copolymers of caprolactone and glycolide, copolymers of trimethylene carbonate and lactide, copolymers of trimethylene carbonate and glycolide, copolymers of caprolactone, glycolide and lactide, copolymers of trimethylene carbonate, glycolide and lactide and mixtures thereof.

2. The polymer composition of claim 1, wherein component a) is a copolymer of glycolide and lactide.

3. The polymer composition of claim 2, wherein said copolymer comprises up to about 50 mole percent glycolide.

4. The polymer composition of claim 1, wherein component b) is present in the blend of an amount of from about 5 to about 10 weight percent, based on the total weight of the blend.

5. The polymer composition of any one of claims 1 to 4, wherein the glycolide/lactide copolymer has an inherent viscosity of from about 0.9 to about 2.0 dl/g

measured at 30°C at a concentration of 0.25 g/dl in chloroform or hexafluoroisopropanol.

6. The polymer composition of claim 2 or 3, wherein the glycolide/lactide copolymer comprises a multi-phase composition, the first phase having from about 0 to about 25 mole percent glycolide moieties and about 75 to about 100 mole percent lactide moieties and the other phase or phases having glycolide and lactide moieties in amounts such that the composition overall has up to 45 mole percent glycolide moieties, wherein the first-phase constitutes at least 50% by weight of copolymer.

7. An absorbable surgical device derived from a polymer composition comprising a blend of:

a) a polymer selected from the group consisting of glycolide homopolymer, lactide homopolymer, a mixture of glycolide homopolymer and lactide homopolymer, a glycolide/lactide copolymer and mixtures thereof; and

b) from about 1 to about 50 weight percent, based on the total weight of the blend, of a polymer selected from the group consisting of copolymers of caprolactone and lactide, copolymers of caprolactone and glycolide, copolymers of trimethylene carbonate and lactide, copolymers of trimethylene carbonate and glycolide, copolymers of caprolactone, glycolide and lactide, copolymers of trimethylene carbonate, glycolide and lactide and mixtures thereof.

8. The absorbable surgical device of claim 7 selected from the group consisting of a fastener, pin, bone screw.

9. Use of the polymer composition of any one of claims 1 to 6 for an absorbable surgical device.

10. In a method of manufacturing a surgical device, the improvement comprising forming said device of a composition of any one of claims 1 to 6.