

WHAT IS CLAIMED IS:

1. A method to remove antigens and cells from a bioprosthetic tissue, comprising:
solubilizing hydrophilic biomolecules within the bioprosthetic tissue utilizing a reducing agent;
solubilizing lipophilic biomolecules within the bioprosthetic tissue utilizing at least one detergent; and
enzymatically degrading biomolecules within the bioprosthetic tissue utilizing at least one of: a nuclease, a lipase, a carbohydrase, or a depolymerase; and
fixing the bioprosthetic tissue, where at least one crosslinking agent is used to fix the bioprosthetic tissue, and wherein the at least one crosslinking agent is glutaraldehyde.
2. The method as in claim 1, wherein:
 - a) the reducing agent is one of: β -mercaptoethanol (BME or 2-ME), *tris*(2-carboxyethyl)phosphine (TCEP), dithiothreitol (DTT), tributylphosphine (TBP of TnBP), or a combination thereof;
 - b) the nuclease is one of: RNase A, DNase I, benzonase, or a combination thereof;
 - c) the lipase is one of: triacylglycerol lipase, pancreatic lipase, or a combination thereof; and/or
 - d) the carbohydrase is one of: amylase, arabanase, cellulase, glucanase, xylanase, or a combination thereof.
3. The method as in any one of the preceding claims, wherein the at least one detergent is a nonionic detergent, a zwitterionic detergent, an ionic detergent, or a plurality of detergents comprising at least one nonionic detergent and at least one ionic detergent.
4. The method as in claim 3, wherein the zwitterionic detergent is one of: amidosulfobetaine-14 (ASB-14), amidosulfobetaine-16 (ASB-16), 4-octylbenzoylamido-propyl-dimethylammoniosulfobetaine (ASB-C80), sulfobetaine 3-10 (SB 3-10), sulfobetaine 3-12 (SB 3-12), sulfobetaine 3-14 (SB 3-14), sulfobetaine 3-16 (SB 3-16), sulfobetaine 3-18 (SB 3-18), 3-[(3-cholamidopropyl)dimethylammonio]-1-propanesulfonate hydrate (CHAPS), 3-[(3-cholamidopropyl)dimethylammonio]-2-hydroxy-1-propanesulfonate (CHAPSO), non-detergent sulfobetaine 195 (NDSB-195), non-detergent sulfobetaine 201

(NDSB-201), non-detergent sulfobetaine 211 (NDSB-211), non-detergent sulfobetaine 221 (NDSB-221), or non-detergent sulfobetaine 256 (NDSB-256).

5. The method as in claim 3, wherein:

a) the nonionic detergent is one of: a polysorbate nonionic detergent, a polyethylene oxide nonionic detergent, *n*-dodecyl- β -D-maltoside (DDM), digitonin, IGEPAL CA-630, *N,N*-bis[3-(D-gluconamido)propyl]cholamide (BigCHAP), or *N,N*-bis[3-(D-gluconamido)propyl]deoxycholamide (Deoxy Big CHAP); and/or

b) the ionic detergent is one of: sodium dodecyl sulfate (SDS), sodium deoxycholate, sodium cholate, sarkosyl, or cetyltrimethylammonium bromide (CTAB).

6. The method as in any one of the preceding claims, wherein the bioprosthetic tissue is animal tissue.

7. The method as in claim 6, wherein:

a) the animal tissue is one of: pericardium, heart valve, blood vessel, small intestinal submucosa, collagen-based tissue, or elastin-based tissue; and/or

b) the animal tissue is one of: bovine, porcine, ovine, avian, or human.

8. The method as in any one of the preceding claims, further comprising: removing undesirable tissue from the bioprosthetic tissue.

9. The method as in claim 8, wherein the undesirable tissue is one of: adipose, venous, cartilaginous, or a combination thereof.

10. The method as in any preceding claims, further comprising:

a) stabilizing aldehyde crosslinks within the bioprosthetic tissue, optionally wherein the stabilizing aldehyde crosslinks comprises treating with heat for an extended period of time; and/or

b) capping free aldehydes within the bioprosthetic tissue, optionally wherein the capping free aldehydes comprises treating with a reducing agent, an amine, or a combination thereof.

11. The method as in any one of the preceding claims, further comprising: capping free carboxyl groups within the bioprosthetic tissue.

12. The method as in claim 11, wherein the capping free carboxyl groups comprises treating with 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (EDC).

13. The method as in any one of the preceding claims, further comprising:

- a) performing a bioburden reduction treatment on the bioprosthetic tissue, optionally wherein the bioburden reduction treatment comprises one of: treatment with cytotoxic reagents, treatment with antimicrobial agents, heat treatment, pressure treatment, radiation treatment, treatment with a detergent, treatment with a crosslinking agent, or a combination thereof;
- b) storing the bioprosthetic tissue within a solution, optionally wherein the solution is a fixation buffer or propylene oxide in water;
- c) treating the bioprosthetic tissue with a solution for dry storage, optionally wherein the solution for dry storage comprises a glycerol, polyethylene glycol, or a saccharide, or a solvent for the solution for dry storage is aqueous based or alcohol based;
- d) sterilizing the bioprosthetic tissue, optionally wherein the sterilizing comprises a treatment selected from the group consisting of: gamma irradiation, gas plasma, aldehydes, ethylene oxide, e-beam, computerized tomography scan, and a combination thereof; and/or
- e) shaping the bioprosthetic tissue, optionally wherein the shaping comprises one of: die cutting, laser cutting, folding, forming, and a combination thereof.

14. The method as in claim 13, wherein glycerolization is performed as the treatment of the bioprosthetic tissue for dry storage, optionally

- a) wherein the solution for dry storage comprises a percentage of glycerol selected from about: 50%, 60%, 70%, 80%, 90%, or 100%, or
- b) wherein the solution for dry storage comprises a percentage of C₁-C₃ alcohol selected from about: 0%, 10%, 20%, 30%, 40%, or 50%.

15. The method as in any one of the preceding claims, wherein the bioprosthetic tissue is utilized in the manufacture of a medical device, optionally wherein the medical device is one of:

- a) a tissue patch, a medical vessel, a conduit, a closure device, or a heart valve; or
- b) a heart valve and the prosthetic tissue is utilized to form leaflets.