What is claimed is:

1. A medical article formed from a polyurethane-based resin, which is a reaction product of ingredients comprising:

a diisocyanate;

a diol chain extender;

a polyglycol; and

an anionic modifier incorporated into a backbone, as a side chain, or both of the polyurethane-based resin formed by the diisocyanate, the polyglycol, and the diol chain extender, the anionic modifier comprising one or more of a $–SO_3^-$ moiety or a $–COO^-$ functional moiety;

the polyurethane-based resin having a hard segment content in a range of from 25% to 75% by weight and a soft segment content of the resin is in a range of from 75% to 25% by weight.

2. The medical article of claim 1, which is effective to reduce thrombus formation and/or bacterial biofilm formation.

3. The medical article of claim 2, which is effective to reduce thrombus formation and/or bacterial biofilm formation due to ionic repulsion of bacteria, protein, and blood components.

4. The medical article of claim 1, wherein the anionic modifier comprises: bis-1,4-((2-hydroxypropoxy)-2-propoxy)-butane sulfonate sodium salt (SULFADIOL®-7Q); 2,3-dihydroxypropane-1-sulfonate sodium salt; N,N-bis(2-hydroxyethyl)-2-aminoethanesulfonate sodium salt; or combinations thereof.

5. The medical article of claim 1, wherein the anionic modifier comprises: 2,2-bis(hydroxymethyl)propionic acid; 2,2-bis(hydroxymethyl)butyric acid (BHMBA); or combinations thereof.

6. The medical article of claim 1, wherein the anionic modifier is present in an amount of greater than or equal to 0.01 weight percent of the overall composition of the polyurethane-based resin.

7. The medical article of claim 1, wherein the anionic modifier is present in an amount of less than or equal to 75 weight percent of the overall composition of the polyurethane-based resin.

8. The medical article of claim 1, wherein the diisocyanate is selected from the group consisting of: an aliphatic diisocyanate, alicyclic diisocyanate and an aromatic diisocyanate.

9. The medical article of claim 1, wherein the diisocyanate is selected from the group consisting of: 4,4’-diphenylmethane diisocyanate (MDI), toluene diisocyanate (TDI), isophorone diisocyanate (IPDI), methylene-bis(4-cyclohexylisocyanate) (HMDI), and combinations thereof.

10. The medical article of claim 1, wherein the diol chain extender is selected from the group consisting of: ethylene glycol, 1,3-propylene glycol, 1,4-butanediol, neopentyl glycol, and alicyclic glycols having up to 10 carbon atoms.

11. The medical article of claim 1, wherein the polyglycol is selected from the group consisting of: polyalkylene glycol, polyester glycol, polycarbonate glycol, and combinations thereof.

12. The medical article of claim 1, wherein the polyglycol comprises the polyalkylene glycol.

13. The medical article of claim 12, wherein the polyalkylene glycol comprises a polytetramethylene ether glycol.

14. The medical article of claim 1, wherein the ingredients of the reaction product consist essentially of:

4,4’-diphenylmethane diisocyanate (MDI) as the diisocyanate;

1,4-butanediol as the diol chain extender;

a polytetramethylene ether glycol as the polyglycol; and

2,2-bis(hydroxymethyl)butyric acid (BHMBA) and/or bis-1,4-((2-hydroxypropoxy)-2-propoxy)-butane sulfonate sodium salt (SULFADIOL®-7Q) as the anionic modifier.

15. The medical article of claim 1, wherein the polyurethane-based resin is bound to a cationic agent through ionic bonding.

16. The medical article of claim 15, wherein the ionic bonding is achieved by a technique comprising a solution imbibing technique or a bulk mixing technique.

17. The medical article of claim 16, wherein the bulk mixing technique comprises a thermal compounding technique and a solvent mixing technique.

18. The medical article of claim 16, wherein the solution imbibing technique comprises: de-protonating a portion of the anionic modifier, and soaking the polyurethane-based resin in a solution of the cationic agent.

19. The medical article of claim 18, wherein the solution imbibing technique further comprises: swelling the polyurethane-based resin before the de-protonating of the portion of the anionic modifier, and rinsing the polyurethane-based resin before the soaking of the polyurethane-based resin in a solution of the cationic agent.

20. The medical article of claim 15, wherein the cationic agent comprises one or more of: an antimicrobial agent, a lubricating agent, a radiopaque agent, and an antithrombotic agent.

21. The medical article of claim 20 comprising the antimicrobial agent, antithrombotic agent, or a combination thereof, which is effective to provide antimicrobial and/or anti-fouling activity.

22. The medical article of claim 21, which is effective to actively provide enhanced surface properties including antimicrobial and/or anti-fouling activity.

23. The medical article of claim 20, wherein the cationic agent comprises one or more of: chlorhexidine acetate, chlorhexidine gluconate, silver sulfadiazine, benzalkonium chloride, cetylpyridinium chloride, a cationic quaternary ammonium and guanidine-containing biocide, a cationic antimicrobial polymer, an antimicrobial peptide or peptide-mimics, and an antifouling phospholipid or phospholipid-mimics.

24. The medical article of claim 20 comprising the radiopaque agent comprising barium cations, bismuth cations, or a combination thereof, which is effective to provide medical article radiopacity.

25. The medical article of claim 1, wherein the ingredients of the reaction product further comprise: a low-surface energy modifying oligomer incorporated into a backbone, as a side

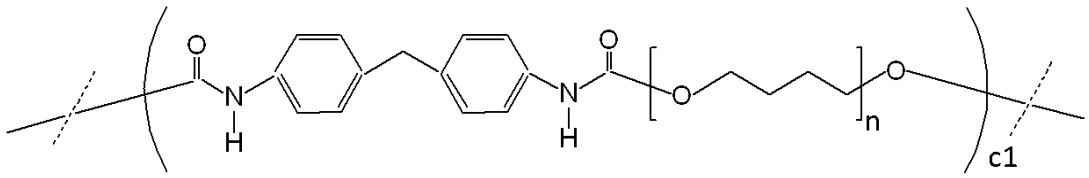
chain, or both of the polyurethane-based resin formed by the diisocyanate, the polyglycol, the anionic modifier, and the diol chain extender.

26. The medical article of claim 25, wherein the modifying oligomer has an alcohol (C-OH) moiety and a functional moiety.

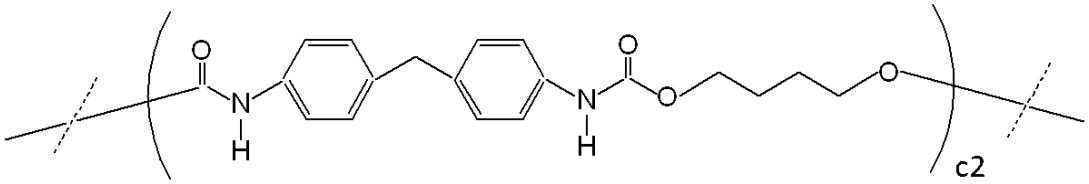
27. The medical article of claim 26, wherein the functional moiety comprises a fluoroether, a silicone, or a combination thereof.

28. The medical article of claim 25, wherein the low-surface energy modifying oligomer is present in an amount ranging from about 0.1 to about 10 weight percent of the overall composition of the polyurethane-based resin.

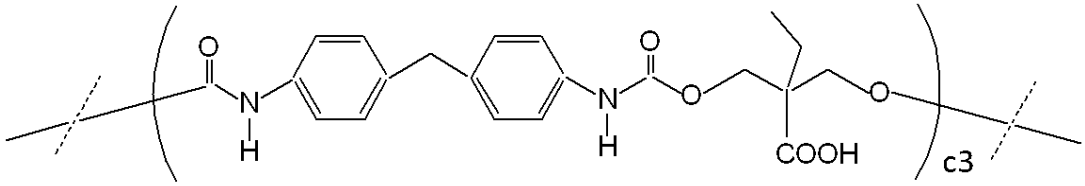
29. A medical article comprising a polyurethane-based resin that is a random copolymer comprising chain segments of (A), (B), and one or both of (C) and (D) as follows:



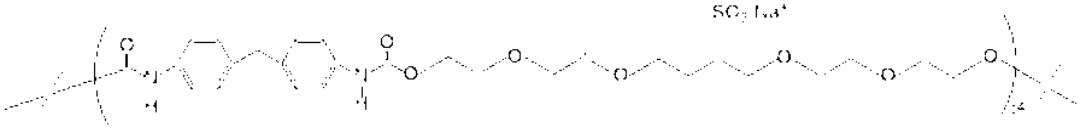
(A) wherein n is in the range of 3 to 40;



(B)



(C)



(D)

wherein a hard segment content is in the range of from 25% to 75% by weight and a soft segment content of the resin is in the range of from 75% to 25% by weight; the polyurethane-based resin has an overall ion exchange capacity of 0.01 to 2.0 mmol/g.