CLAIMS

1. A device for reducing biofouling on a substrate at least partially submerged in an aqueous environment, the device comprising:

a structure comprising at least one vertically extending flexible sheet layer which is or becomes water permeable during use, the at least one vertically extending flexible sheet layer substantially surrounding at least a portion of a periphery of the substrate in the aqueous environment, the at least one vertically extending flexible sheet layer having an upper end at or near a surface of the aqueous environment and a lower end which extends downward into the aqueous environment to a first depth;

the structure defining a bottom which is at least partially open to the aqueous environment;

in which the structure separates the aqueous environment into a local aqueous environment and an open aqueous environment, in which the local aqueous environment extends from a surface of the substrate to at least an inner surface of the at least one vertically extending flexible sheet layer;

in which the structure provides an average water exchange of about 0.1% to 500% of a volume of water each hour between the local aqueous environment and the open aqueous environment.

2. A device according to Claim 1, in which a lowest point of the substrate extends a second depth into the aqueous environment, and the first depth is greater than the second depth.

3. A device according to Claim 1, in which the substrate extends into the aqueous environment to a second depth, and the first depth is less than or equals the second depth.

4. A device according to Claim 1, in which the at least one vertically extending flexible sheet layer comprises a water permeable fabric.

5. A device according to Claim 1, in which the at least one vertically extending flexible sheet layer comprises a 3-dimensional flexible material selected from the group consisting of natural and synthetic fabrics, natural and synthetic membranes, natural and synthetic sheets, and fabrics, membranes, films and sheets made from a combination of natural and synthetic materials.

6. A device according to Claim 1, in which the structure maintains a dissolved oxygen content of a liquid within the local aqueous environment of at least an average of 10% or greater.

7. A device according to Claim 1, in which water chemistry within the local aqueous environment is different than water chemistry within the open aqueous environment.

8. A device according to Claim 1, in which a ratio of a surface area of the structure to a volume of water within the local aqueous environment is about 0.4 $feet^{-1}$ to about 800 $feet^{-1}$ upon positioning the structure about the substrate.

9. A device according to Claim 1, in which the at least one vertically extending flexible sheet layer comprises biocide.

10. A device according to Claim 1, in which the structure defines a top which is at least partially open.

11. A device according to Claim 1, further comprising an aqueous flow mechanism that is positioned within the local aqueous environment, in which the aqueous flow mechanism is configured to at least one of disturb the local aqueous environment or add or remove liquid, compounds, or other materials to or from the local aqueous environment.

12. A device according to Claim 1, further comprising a modification compound that is positioned within the local aqueous environment, in which the modification compound is configured to condition the local aqueous environment by applying a change in water chemistry of the local aqueous environment.

13. A device for reducing biofouling on a substrate at least partially submerged in an aqueous environment, the device comprising:

a structure comprising a plurality of vertically extending flexible sheets, the plurality of vertically extending flexible sheets surrounding a periphery of the substrate in the aqueous environment, each of the plurality of vertically extending flexible sheets having an upper end at or near a surface of the aqueous environment and a lower end which extends downward into the aqueous environment;

in which the structure is open to the aqueous environment at a bottom end of the structure;

in which a surface area of the structure is at least equal to or greater than a surface area of the substrate.

14. A device according to Claim 13, in which the lower end of at least one of the plurality of vertically extending flexible sheets extends downward into the aqueous environment to a first depth, in which a lowest point of the substrate extends a second depth into the aqueous environment, and the first depth is greater than the second depth.

15. A device according to Claim 13, in which the lower end of at least one of the plurality of vertically extending flexible sheets extends downward into the aqueous environment to a first depth, in which the substrate extends into the aqueous environment to a second depth, and the first depth is less than or equals the second depth.

16. A device according to Claim 13, in which each of the plurality of vertically extending flexible sheets comprise a 3-dimensional flexible material selected from the group consisting of natural and synthetic fabrics, natural and synthetic membranes, natural and synthetic sheets, and fabrics, membranes, films and sheets made from a combination of natural and synthetic materials.

17. A device for reducing biofouling on a substrate at least partially submerged in an aqueous environment, the device comprising:

a structure comprising at least one vertically extending flexible sheet layer which is or becomes water permeable during use, the at least one vertically extending flexible sheet layer substantially surrounding at least a portion of a periphery of the substrate in the aqueous environment, the at least one vertically extending flexible sheet layer having an upper end at or near a surface of the aqueous environment and a lower end which extends downward into the aqueous environment to a first depth;

the structure defining a bottom which is at least partially open to the aqueous environment;

in which the at least one vertically extending flexible sheet layer comprises a 3-dimensional flexible material selected from the group consisting of natural and synthetic fabrics, natural and synthetic membranes, natural and synthetic sheets, and fabrics, membranes, films and sheets made from a combination of natural and synthetic materials.

18. A device according to Claim 17, in which the structure is configured to attach to a floatable device to extend downwardly into the aqueous environment.

19. A device according to Claim 18, further comprising one or more connection features configured to attach to the floatable device, in which the structure is connected to the one or more connection features so as to extend downwardly into the aqueous environment below the floatable device.

20. A device according to Claim 19, in which the structure forms a skirt for the floatable device.

21. A device according to Claim 17, in which the structure is configured to attach to and surround a floatable device to reduce biofouling on the floatable device.

22. A device according to Claim 17, in which the structure is fluid permeable and comprises at least one of mesh, lattice, fenestration, or holes that enable fluid flow therethrough, in which the structure is flexible and defines a first side and a second side,

in which, when the structure at least partially surrounds the substrate in the aqueous environment such that the first side of the structure faces the substrate, the structure enables fluid exchange through the structure to the substrate while preventing or limiting biofouling on the substrate such that a first chemistry of the aqueous environment on the first side of the structure is different than a second chemistry of the aqueous environment on the second side of the structure.

23. A device according to Claim 22, in which, when the structure at least partially surrounds the substrate in the aqueous environment, the structure modulates dissolved oxygen content between the second side and the first side.

24. A device according to Claim 17, in which the structure further comprises at least one removeable vertically extending flexible sheet layer, in which the at least one removeable vertically extending flexible sheet layer is configured to collect biofouling thereon and is positioned proximate to an outer surface of the at least one vertically extending flexible sheet layer, in which the at least one removeable vertically extending flexible sheet layer and biofouling thereon can be removed from the structure to leave the at least one vertically extending flexible sheet layer substantially surrounding the portion of the periphery of the substrate in the aqueous environment.

25. A device according to Claim 17, in which the at least one vertically extending flexible sheet layer comprises biocide.

CLAIMS

1. A device for reducing biofouling on a surface at least partially submerged in an aqueous environment, the device comprising:

a structure comprising at least one flexible layer which is or becomes water permeable during use and which is formed of at least one of mesh, lattice, fenestration, or holes that enable fluid flow therethrough, the structure substantially surrounding at least a portion of a periphery of the surface in the aqueous environment, the structure having an upper end and a lower end which extends downward into the aqueous environment to a first depth;

the structure defining at least one opening that forms one or more paths in the aqueous environment around the structure leading toward the surface such that fluid from the aqueous environment is able to flow around the structure, through the at least one opening, and toward the surface without having to pass through the at least one of mesh, lattice, fenestration, or holes;

in which the at least one flexible layer comprises a 3-dimensional flexible material.

2. A device according to Claim 1, in which the structure is configured to attach to a floatable device to extend downwardly into the aqueous environment from a top to a bottom.

3. A device according to Claim 2, further comprising one or more connection features configured to attach to the floatable device, in which the structure is connected to the one or more connection features so as to extend downwardly into the aqueous environment below the floatable device.

4. A device according to Claim 2, in which the structure forms a skirt for the floatable device.

5. A device according to Claim 1, in which the structure is configured to attach to and surround a floatable device to reduce biofouling on the floatable device.

6. A device according to Claim 1, in which the structure is flexible and defines a first side and a second side,

in which, when the structure at least partially surrounds the surface in the aqueous environment such that the first side of the structure faces the surface, the structure

allows fluid exchange through the structure to the surface while preventing or limiting biofouling on the surface such that a first chemistry of the aqueous environment between the surface and the first side of the structure is different than a second chemistry of the aqueous environment on the second side of the structure, in which the first chemistry is measured in the aqueous environment proximate the surface, in which the second chemistry is measured in the aqueous environment at a spaced apart distance from the second side of the structure facing away from the surface.

7. A device according to Claim 6, in which, when the structure at least partially surrounds the surface in the aqueous environment, the structure modulates dissolved oxygen content between the second side and the first side.

8. A device according to Claim 1, in which the structure further comprises a plurality of flexible layers, in which at least one of the plurality of flexible layers is removeable from a remaining set of the plurality of flexible layers.

9. A device according to Claim 1, in which the a structure comprises biocide.

10. The device according to Claim 6, in which the spaced apart distance from the second side of the structure is 12 inches.

11. The device according to Claim 1, in which a surface area of the structure is less than a surface area of the surface.

12. The device according to Claim 1, in which a lowest point of the surface extends to a second depth into the aqueous environment, and the first depth is greater than the second depth.

13. The device according to Claim 1, in which the surface extends into the aqueous environment to a second depth, and the first depth is less than or equals the second depth.

14. The device according to Claim 1, in which the structure provides an average water exchange of about 0.1% to 500% of a volume of water each hour therethrough.

15. The device according to Claim 1, further comprising an aqueous flow mechanism that is positioned between the structure and the surface, in which the aqueous flow mechanism is configured to at least one of disturb the aqueous environment or add or remove liquid, compounds, or other materials to or from the aqueous environment.

16. The device according to Claim 1, further comprising a modification compound that is positioned between the structure and the surface, in which the modification compound is configured to condition the aqueous environment by applying a change in water chemistry of the aqueous environment.

17. A roll of material used to form the device according to any preceding claim, in which the material includes the structure.

18. A method of reducing biofouling on a surface at least partially submerged in an aqueous environment, the method comprising:

providing a structure comprising at least one flexible layer which is or becomes water permeable during use and which is formed of at least one of mesh, lattice, fenestration, or holes that enable fluid flow therethrough, in which the at least one flexible layer comprises a 3-dimensional flexible material; and

positioning the structure into the aqueous environment so as to substantially surround at least a portion of a periphery of the surface in the aqueous environment and such that the structure has an upper end and a lower end which extends downward into the aqueous environment to a first depth,

the structure defining at least one opening that forms one or more paths in the aqueous environment around the structure leading toward the surface such that fluid from the aqueous environment is able to flow around the structure, through the at least one opening, and toward the surface without having to pass through the at least one of mesh, lattice, fenestration, or holes.

19. A method according to Claim 18, further comprising causing an aqueous flow mechanism to at least one of disturb the aqueous environment between the structure and the surface or add or remove liquid, compounds, or other materials to or from the aqueous environment between the structure and the surface.

20. A method according to Claim 18, further comprising positioning a modification compound between the structure and the surface, in which the modification compound is configured to condition the aqueous environment by applying a change in water chemistry of the aqueous environment.