Claims

1. A moving bed bioreactor, comprising:

a reactor vessel, comprising: a treatment section for holding a plurality of biofilm carrier elements and an outlet section in fluid communication with the treatment section;

an agitator for imparting motion to the biofilm carrier elements, the agitator comprising at least one gas entrainment device comprising at least one pressure source and configured to inject a pressurized gas into the reactor vessel; and

an airlift pump system for pumping treated water from the outlet section,

wherein the reactor vessel is buoyant and comprises at least one sidewall and a lower wall, the at least one sidewall and/or the lower wall having a plurality of apertures for allowing flow of water into and out of the chamber when the reactor vessel is immersed in a body of water, each of said apertures being sized to prevent flow of the biofilm carrier elements out of the reactor vessel, and

wherein the at least one pressure source acts as a pressure source for the airlift pump system.

2. A moving bed bioreactor according to claim 1, wherein the outlet section is separated from the treatment section by a screen which is configured to prevent egress of biofilm carrier elements while permitting flow of water.

3. A moving bed bioreactor according to claim 1 or claim 2, wherein the gas entrainment device is an aeration device or an oxygenation device.

4. A moving bed bioreactor according to any one of claims 1 to 3, wherein the gas entrainment device comprises at least one pipe having a plurality of apertures formed in at least a portion thereof, the at least a portion being disposed in the treatment section.

5. A moving bed bioreactor according to claim 4, comprising a plurality of pipes arranged concentrically with respect to each other.

6. A moving bed bioreactor according to claim 4 or claim 5, wherein the apertures of said pipe or pipes are disposed in a portion of the treatment section adjacent the lower wall.

7. A moving bed bioreactor according to any one of the preceding claims, wherein the airlift pump system comprises an airlift pipe disposed in the outlet section.

8. A moving bed bioreactor according to claim 7, wherein the screen is disposed around the airlift pipe.

9. A moving bed bioreactor according to any one of the preceding claims, wherein the at least one pressure source is a compressor or blower system located remotely from the reactor vessel.

10. A moving bed bioreactor according to any one of the preceding claims, comprising a spacer element for elevating the lower wall.

11. A moving bed bioreactor according to any one of the preceding claims, further comprising a plurality of biofilm carrier elements disposed in the treatment section.

12. A moving bed bioreactor according to any one of the preceding claims, wherein the reactor vessel is generally cylindrical.

13. A moving bed bioreactor according to claim 12, wherein the reactor vessel has a diameter approximately 1.5 times its height.

14. A water treatment process, comprising:

disposing a plurality of biofilm carrier elements in a treatment section of a reactor vessel having a plurality of apertures, each of said apertures being sized to prevent flow of the biofilm carrier elements out of the reactor vessel;

immersing the reactor vessel in a body of water such that the reaction vessel floats and water enters the treatment section from the body of water through the plurality of apertures and mixes with the biofilm carrier elements; agitating the biofilm carrier elements;

allowing treated water to flow to an outlet section of the reactor vessel while retaining the biofilm carrier elements in the treatment section; and

airlift pumping the treated water from the outlet section to the body of water,

wherein said agitating comprises injecting a pressurized gas into the reactor vessel and a common pressure source is used for said agitating and said airlift pumping.

15. A water treatment process according to claim 14, wherein said agitating comprises injecting a pressurized gas into the reactor vessel.

16. A water treatment process according to claim 15, wherein the gas is air or oxygen.

17. A water treatment process according to claim 15 or claim 16, wherein the gas is injected at a plurality of injection points arranged concentrically with respect to each other.

18. A water treatment process according to claim 17, wherein the injection points are located adjacent a lower wall of the reactor vessel.

19. A water treatment process according to any one of claims 19 to 23, wherein the treated water is expelled by pumping.