CLAIMS

What is claimed is:

1. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a gas extraction area; and

a separator wherein separator comprises a substantially continuous helical configuration having two inclined surfaces forming a "V" shape;

wherein the separator directs flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode, and wherein the separator is further configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode.

2. The electrolytic cell of claim 1 wherein the separator comprises the first electrode.

3. The electrolytic cell of claim 2 wherein the separator further comprises a dielectric material.

4. The electrolytic cell of claim 3 further comprising a microorganism, wherein the separator substantially retains the microorganism in a desired location.

5. The electrolytic cell of claim 1 wherein the first electrode and the second electrode are configured to allow the polarity of the first electrode and the second electrode to reverse.

6. The electrolytic cell of claim 1 wherein the separator comprises the first electrode and the first electrode comprises a first conductive material proximal to the source of electrical current and a dielectric material distal to the source of electrical current.

7. The electrolytic cell of claim 6 wherein the first electrode further comprises a second conductive material proximal to the dielectric material and distal to the source of electrical current.

8. The electrolytic cell of claim 1 wherein the first electrode comprises a spring structure for vibration to promote release of nucleated gas from the electrodes

9. The electrolytic cell of claim 1 wherein the first electrode is configured to vibrate at a rate to promote circulation of the electrolyte.

10. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a gas extraction area; and

a separator wherein separator comprises two inclined surfaces forming a "V" shape, wherein the separator directs flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode, and wherein the separator is further configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode.

11. The electrolytic cell of claim 10 wherein the separator comprises the first electrode.

12. The electrolytic cell of claim 11 wherein the separator further comprises a dielectric material.

13. The electrolytic cell of claim 10 wherein separator comprises a substantially continuous helical configuration.

14. The electrolytic cell of claim 10 wherein separator comprises a substantially continuous multiple start helical configuration.

15. The electrolytic cell of claim 10 further comprising a microorganism, wherein the separator substantially retains the microorganism in a desired location.

16. The electrolytic cell of claim 10 wherein the first electrode and the second electrode are configured to allow the polarity of the first electrode and the second electrode to reverse.

17. The electrolytic cell of claim 10 wherein the separator comprises the first electrode and the first electrode comprises a first conductive material proximal to the source of electrical current and a dielectric material distal to the source of electrical current.

18. The electrolytic cell of claim 17 wherein the first electrode further comprises a second conductive material proximal to the dielectric material and distal to the source of electrical current.

19. The electrolytic cell of claim 10 wherein the first electrode comprises a spring structure for vibration to promote release of nucleated gas from the electrodes

20. The electrolytic cell of claim 19 wherein the first electrode is configured to vibrate at a rate to promote circulation of the electrolyte.

21. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and

the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode; and

a separator;

wherein the separator includes an inclined surface to direct flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode.

22. The electrolytic cell of claim 21 further comprising a gas extraction area wherein the separator is configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode.

23. The electrolytic cell of claim 22 wherein the separator comprises the first electrode.

24. The electrolytic cell of claim 23 wherein the separator further comprises a dielectric material.

25. The electrolytic cell of claim 22 wherein separator comprises two inclined surfaces forming a "V" shape.

26. The electrolytic cell of claim 25 wherein separator comprises at least two stacked plates, wherein each stacked plate comprises two inclined surfaces forming a "V" shape.

27. The electrolytic cell of claim 25 wherein separator comprises a substantially continuous helical configuration having an inclined surface.

28. The electrolytic cell of claim 25 wherein separator comprises a substantially continuous multiple start helical configuration having an inclined surface.

29. The electrolytic cell of claim 22 further comprising a microorganism, wherein the separator substantially retains the microorganism in a desired location.

30. The electrolytic cell of claim 22 wherein the first electrode and the second electrode are configured to allow the polarity of the first electrode and the second electrode to reverse.

31. The electrolytic cell of claim 22 wherein the separator comprises the first electrode and the first electrode comprises a first conductive material proximal to the source of electrical current and a dielectric material distal to the source of electrical current.

32. The electrolytic cell of claim 31 wherein the first electrode further comprises a second conductive material proximal to the dielectric material and distal to the source of electrical current.

33. The electrolytic cell of claim 22 wherein the first electrode comprises a spring structure for vibration to promote release of nucleated gas from the electrodes

34. The electrolytic cell of claim 33 wherein the first electrode is configured to vibrate at a rate to promote circulation of the electrolyte.

1. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a gas extraction area; and

a separator wherein separator comprises a substantially continuous helical configuration having two inclined surfaces forming a "V" shape;

wherein the separator directs flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode, and wherein the separator is further configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode.

2. The electrolytic cell of claim 1 wherein the separator comprises the first electrode.

3. The electrolytic cell of claim 2 wherein the separator further comprises a dielectric material.

4. The electrolytic cell of claim 3 further comprising a microorganism, wherein the separator substantially retains the microorganism in a desired location.

5. The electrolytic cell of claim 1 wherein the first electrode and the second electrode are configured to allow the polarity of the first electrode and the second electrode to reverse.

6. The electrolytic cell of claim 1 wherein the separator comprises the first electrode and the first electrode comprises a first conductive material proximal to the source of electrical current and a dielectric material distal to the source of electrical current.

7. The electrolytic cell of claim 6 wherein the first electrode further comprises a second conductive material proximal to the dielectric material and distal to the source of electrical current.

8. The electrolytic cell of claim 1 wherein the first electrode comprises a spring structure for vibration to promote release of nucleated gas from the electrodes

9. The electrolytic cell of claim 1 wherein the first electrode is configured to vibrate at a rate to promote circulation of the electrolyte.

10. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a gas extraction area; and

a separator, wherein separator comprises two inclined surfaces forming a "V" shape and wherein the separator comprises the first electrode,

wherein the separator directs flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode, and wherein the separator is further configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode.

11. The electrolytic cell of claim 10 wherein the separator further comprises a dielectric material.

12. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a gas extraction area; and

a separator, wherein separator comprises two inclined surfaces forming a "V" shape and wherein separator comprises a substantially continuous multiple start helical configuration,

wherein the separator directs flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode, and wherein the separator is further configured to promote

circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode.

13. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a gas extraction area; and

a separator, wherein separator comprises two inclined surfaces forming a "V" shape and , wherein the separator comprises the first electrode and the first electrode comprises a first conductive material proximal to the source of electrical current and a dielectric material distal to the source of electrical current,

wherein the separator directs flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode, and wherein the separator is further configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode.

14. The electrolytic cell of claim 13 wherein the first electrode further comprises a second conductive material proximal to the dielectric material and distal to the source of electrical current.

15. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a separator, wherein the separator comprises the first electrode, and

a gas extraction area wherein the separator is configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode

wherein the separator includes an inclined surface to direct flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode.

16. The electrolytic cell of claim 15 wherein the separator further comprises a dielectric material.

17. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a separator, wherein separator comprises two inclined surfaces forming a "V" shape wherein separator comprises a substantially continuous helical configuration having an inclined surface, and

a gas extraction area wherein the separator is configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode

wherein the separator includes an inclined surface to direct flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode.

18. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a separator, wherein separator comprises two inclined surfaces forming a "V" shape wherein separator comprises a substantially continuous multiple start helical configuration having an inclined surface; and

a gas extraction area wherein the separator is configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode;

wherein the separator includes an inclined surface to direct flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode.

19. An electrolytic cell comprising:

a containment vessel;

a first electrode;

a second electrode;

a source of electrical current in electrical communication with the first electrode and the second electrode;

an electrolyte in fluid communication with the first electrode and the second electrode;

a gas, wherein the gas is formed during electrolysis at or near the first electrode;

a separator, wherein the separator comprises the first electrode and the first electrode comprises a first conductive material proximal to the source of electrical current and a dielectric material distal to the source of electrical current; and

a gas extraction area wherein the separator is configured to promote circulation of the electrolyte between the first electrode, the gas extraction area, and the second electrode to provide fresh electrolyte to the first electrode and the second electrode;

wherein the separator includes an inclined surface to direct flow of the electrolyte and the gas due to a difference between density of the electrolyte and the combined density of the electrolyte and the gas such that the gas substantially flows in a direction distal to the second electrode.

20. The electrolytic cell of claim 19 wherein the first electrode further comprises a second conductive material proximal to the dielectric material and distal to the source of electrical current.