

What is claimed is:

1. A method of removing carbon dioxide from an aqueous stream or gaseous stream by:
contacting the gaseous stream comprising carbon dioxide, when present, with an aqueous solution comprising ions capable of forming an insoluble carbonate salt;
contacting the aqueous solution comprising carbon dioxide with an electroactive mesh that induces its alkalization thereby forcing the precipitation of a carbonate solid(s) from the solution; and
removing the precipitated carbonate solids from the solution, or the surface of the mesh where they may deposit.
2. The method of claim 1, wherein the gaseous stream is present.
3. The method of claim 1 or 2, wherein the gaseous stream comprises between 0.04 to 100 vol. % CO₂.
4. The method of any one of claims 1 to 3, wherein the gaseous fluid is atmospheric air.
5. The method of any one of claims 1 to 4, wherein the gaseous fluid is flue gas emitted from a natural gas-fired power plant, a coal-fired power plant, an iron mill, a steel mill, a cement plant, an ethanol plant, and a chemical manufacturing plant.
6. The method of any one of claims 1 to 5, wherein the aqueous solution contains an amount of dissolved carbon dioxide that is in equilibrium with the gaseous stream.
7. The method of any one of claims 1 to 6, wherein the aqueous solution is in thermal equilibrium with the gaseous stream.
8. The method of any one of claims 1 to 6, wherein the aqueous solution is not in thermal equilibrium with the gaseous stream.
9. The method of claim 1, wherein the gaseous stream is not present.

10. The method of any one of claims 1 to 9, wherein the ions capable of forming an insoluble carbonate salt comprise ions including one or more of the following Ca, Mg, Ba, Sr, Fe, Zn, Pb, Cd, Mn, Ni, Co, Cu, and Al.
11. The method of any one of claims 1 to 10, wherein the aqueous solution has a concentration of NaCl of about 1,000 ppm or more.
12. The method of any one of claims 1 to 11, wherein the aqueous solution has a concentration of NaCl of about 30,000 ppm or more.
13. The method of any one of claims 1 to 12, wherein the aqueous solution comprises seawater.
14. The method of any one of claims 1 to 13, wherein the electroactive mesh comprises a mesh cathode that comprises a metallic or a non-metallic composition.
15. The method of any one of claims 1 to 14, wherein the method utilizes an end-to-end energy intensity of about 2.5 MWh or less per ton of carbon dioxide mineralized.
16. The method of any one of claims 1 to 15, wherein the aqueous solution contains an amount of dissolved carbon dioxide that is buffered to atmospheric abundance.
17. The method of any one of claims 1 to 16, wherein the electroactive mesh produces an increased alkaline condition, *in situ*, in the aqueous solution within about 2 to 20000 μm of the electroactive mesh.
18. The method of claim 17, wherein the alkalized condition is a pH of 9 or greater.
19. The method of any one of claims 1 to 18, wherein the electroactive mesh consists of a metallic or carbon-based mesh.
20. The method of claim 19, wherein the electroactive mesh contains stainless steel, titanium oxide, carbon nanotubes, polymers, and/or graphite, or other hybrid compositions of these materials.

21. The method of any one of claims 1 to 20, wherein the electroactive mesh comprises pores having a diameter in the range of about 0.1 μm to about 10000 μm .
22. The method of any one of claims 1 to 21, wherein inducing the precipitation of the carbonate solid includes rotating a cylinder consisting of the electroactive mesh in the solution, while applying suction to draw the solution onto the outer surface of the mesh.
23. The method of any one of claims 1 to 22, wherein the solution is a brine solution.
24. The method of any one of claims 1 to 23, wherein the solution is an alkaline metal-containing solution.
25. The method of any one of claims 1 to 24, wherein inducing precipitation of the carbonate solid includes inducing precipitation of at least one carbonate having Ca, Mg, Ba, Sr, Fe, Zn, Pb, Cd, Mn, Ni, Co, Cu, or Al.
26. A flow-through electrolytic reactor comprising an intake device in fluid connection with a rotating cylinder comprising an electroactive mesh, and a scraping device and/or liquid-spray based device for separating a solid from a surface or solution.
27. The flow-through electrolytic reactor of claim 26, further comprising an aqueous solution comprising carbon dioxide, Ca ions, and Mg ions.
28. The flow-through electrolytic reactor of claim 16 or 17, wherein the electroactive mesh is capable of inducing removal of dissolved inorganic carbon by precipitation of a carbonate solid from an aqueous solution comprising carbon dioxide and ions capable of forming an insoluble carbonate salt.
29. The flow-through electrolytic reactor of any one of claims 26 to 28, wherein the electroactive mesh contains a metallic or carbon-based mesh.
30. The flow-through electrolytic reactor of claim 29, wherein the electroactive mesh contains stainless steel, titanium oxide, carbon nanotubes, polymers, and/or graphite, or hybrid compositions of these materials.

31. The flow-through electrolytic reactor of any one of claims 26 to 30, wherein the reactor comprises a plurality of electroactive meshes.
32. The flow-through electrolytic reactor of claim 31, wherein the plurality of electroactive meshes are arranged in a series of planar cells in parallel or cylindrical cells in parallel.
33. The flow-through electrolytic reactor of any one of claims 16 to 32, wherein the reactor is in fluid communication with a desalination device.