CLAIMS

What is claimed is:

1. A system, comprising:

a centrifugal pump comprising a mixing chamber, wherein said centrifugal pump is configured to move a fluid from a reservoir into said mixing chamber;

a gas supply for injecting a first quantity of gas into said fluid inside said mixing chamber to produce a first solution containing a first volume of gas nanobubbles;

a pressure vessel for receiving said first solution from said centrifugal pump, wherein said pressure vessel is configured to hold said first solution under an internal pressure and for a selected duration to produce a second solution, wherein said second solution contains a second volume of gas nanobubbles in addition to said first volume; and

one or more nozzles for spraying said second solution into said reservoir, wherein said one or more nozzles is sized and shaped to release a portion of said volumes of gas nanobubbles into said fluid,

wherein said centrifugal pump is configured to circulate said fluid in and through a circuit of elements comprising said reservoir, said centrifugal pump, said pressure vessel, and said one or more nozzles, until a desired quantity of pollutants is removed from said fluid.

2. The system of claim 1, wherein said circuit of elements further comprises:

a backflow valve for receiving said second solution from said pressure vessel, wherein said backflow valve is configured to increase said internal pressure inside said pressure vessel, and to prolong said selected duration inside said pressure vessel,

such that said pressure vessel produces a third solution, wherein said third solution contains a third volume of gas nanobubbles in addition to said first volume and said second volume.

3. The system of claim 1, wherein said circuit of elements further comprises:

a Venturi injector for receiving said second solution from said pressure vessel, wherein said Venturi injector is configured to inject a supplemental quantity of gas into said fluid to produce a fourth solution, wherein said fourth solution contains a fourth volume of gas nanobubbles in addition to said first volume and said second volume.

4. The system of claim 3, wherein said circuit of elements further comprises:

a recirculation pipe including a recirculation valve configured to deliver a selected portion of said second solution to said Venturi injector; and

a supplemental gas inlet tube connected to a suction port of said Venturi injector to supply said supplemental quantity of gas,

wherein said Venturi injector comprises a lengthwise chamber defined by a side wall and said suction port in said side wall, wherein said lengthwise chamber is sized and shaped to create a pressure differential sufficient to draw said supplemental quantity of gas through said suction port and into said select portion of said second solution.

5. The system of claim 1, wherein said first quantity of gas is an ozone-rich gas, and said gas supply comprises:

an oxygen concentrator for converting ambient air into an oxygen-enriched gas;

an ozone generator in fluid communication with said oxygen concentrator for converting said oxygen-enriched gas into said ozone-rich gas; and

a gas inlet tube in fluid communication with said ozone generator and configured to deliver said ozone-rich gas to said mixing chamber inside said centrifugal pump.

6. The system of claim 1, wherein said pressure vessel further comprises:

a diverter pipe wall defining a chamber extending lengthwise and substantially vertically inside said pressure vessel from a base end to a distal end, wherein said chamber is in fluid communication with said pressure vessel and with a connecting pipe from said pump, wherein said diverter pipe wall further defines a plurality of perforations therethrough;

a vent positioned to release an excess volume of ozone-rich gas from said pressure vessel, said excess volume characterized by its having not been injected and dissolved into said first solution; and

a deflector that is sized and shaped and positioned to selectively inhibit flow of said first solution into said vent, such that said deflector selectively prolongs said selected duration during which said first solution remains inside said pressure vessel.

7. The system of claim 1, wherein said one or more nozzles comprises a pair of nozzles spaced apart from one another and immersed in said reservoir to a depth located at a mean height above a floor of said reservoir,

wherein each of said pair of nozzles comprises a nozzle body defining one or more flow passages converging toward one or more outlets.