CLAIMS

1. A system for determining composition of an aqueous solution, comprising:

a feed line having a feed inlet fluidly connectable to a source of the aqueous solution comprising a concentration of hydrogen peroxide and a concentration of dissolved oxygen;

an oxygen removal unit fluidly connected to the feed line downstream from the feed inlet;

a dissolved oxygen analyzer fluidly connected to the feed line downstream from the oxygen removal unit, the feed line fluidly connecting the feed inlet to the dissolved oxygen analyzer;

a first conduit fluidly connected to the feed line between the oxygen removal unit and the dissolved oxygen analyzer;

a hydrogen peroxide removal unit fluidly connected to the first conduit downstream from the oxygen removal unit, the first conduit fluidly connecting the feed inlet to an effluent outlet downstream from the hydrogen peroxide removal unit;

a second conduit fluidly connected to the first conduit between the hydrogen peroxide removal unit and the effluent outlet, the second conduit extending back to the feed line, the second conduit fluidly connecting the hydrogen peroxide removal unit to the dissolved oxygen analyzer;

a first valve positioned on the first conduit between the hydrogen peroxide removal unit and the effluent outlet;

a second valve positioned on the feed line between the oxygen removal unit and the dissolved oxygen analyzer; and

a control module operably connected to the dissolved oxygen analyzer, the first valve, and the second valve, the control module configured to calculate a concentration of hydrogen peroxide in the source of the aqueous solution from a first concentration of dissolved oxygen measured by opening the second valve to bypass the hydrogen peroxide removal unit and direct the aqueous solution to the dissolved oxygen analyzer and a second concentration of dissolved oxygen measured by closing the second valve to direct the aqueous solution through the first conduit and the hydrogen peroxide removal unit to the dissolved oxygen analyzer, and responsive to the calculated concentration of hydrogen peroxide, the control module further being configured to actuate the first valve to selectively direct the effluent to the effluent outlet or the second conduit.

2. The system of claim 1, further comprising a third valve positioned on the second conduit between the hydrogen peroxide removal unit and the dissolved oxygen analyzer.

3. The system of claim 1, wherein the dissolved oxygen analyzer comprises a display unit configured to display dissolved oxygen concentration.

4. The system of claim 1, wherein the control module is programmed to direct the effluent to the effluent outlet responsive to the calculated concentration of hydrogen peroxide being within about 10 ppb of a target concentration.

5. The system of claim 4, wherein the control module is capable of calculating the concentration of hydrogen peroxide to be about 2 ppb or less.

6. The system of claim 1, wherein the oxygen removal unit comprises at least one of a vacuum degasification unit, a gas transfer membrane, an oxygen scavenging media, and a vacuum mechanical agitation unit.

7. The system of claim 1, wherein the hydrogen peroxide removal unit comprises a catalyst-driven hydrogen peroxide removal unit.

8. The system of claim 7, wherein the catalyst-driven hydrogen peroxide removal unit comprises at least one of a heterogeneous catalyst comprising palladium-doped anion exchange resin, a heterogeneous catalyst comprising platinum immobilized on a substrate, and a homogeneous catalyst comprising an enzyme.

9. A system for determining composition of an aqueous solution, comprising:

a feed line having a feed inlet fluidly connectable to a source of the aqueous solution comprising a concentration of hydrogen peroxide and a concentration of dissolved oxygen;

an oxygen removal unit fluidly connected to the feed line downstream from the feed inlet;

a first dissolved oxygen analyzer fluidly connected to the feed line downstream from the oxygen removal unit, the feed line fluidly connecting the feed inlet to the first dissolved oxygen analyzer;

a first conduit fluidly connected to the feed line downstream from the oxygen removal unit;

a hydrogen peroxide removal unit fluidly connected to the first conduit downstream from the oxygen removal unit, the first conduit fluidly connecting the feed inlet to an effluent outlet downstream from the hydrogen peroxide removal unit;

a second dissolved oxygen analyzer fluidly connected to the first conduit downstream from the hydrogen peroxide removal unit;

a second conduit fluidly connected to the first conduit between the hydrogen peroxide removal unit and the effluent outlet, the second conduit extending back to the feed line;

a first valve positioned on the first conduit between the hydrogen peroxide removal unit and the effluent outlet;

a second valve positioned on the feed line downstream from the oxygen removal unit; and

a control module operably connected to the first dissolved oxygen analyzer, the second dissolved oxygen analyzer, the first valve, and the second valve, the control module programmed to calculate a concentration of hydrogen peroxide in the source of the aqueous solution from a first concentration of dissolved oxygen measured by the first dissolved oxygen analyzer and a second concentration of dissolved oxygen measured by closing the second valve to direct the aqueous solution through the first conduit and the hydrogen peroxide removal unit to the second dissolved oxygen analyzer and responsive to the calculated concentration of hydrogen peroxide, the control module further being configured to actuate the first valve to selectively direct an effluent from the hydrogen peroxide removal unit to the effluent outlet or the second conduit.

10. The system of claim 9, wherein the first and second dissolved oxygen analyzers comprise a display unit configured to display dissolved oxygen concentration.

11. The system of claim 9, wherein the control module is programmed to direct the effluent to the effluent outlet responsive to the calculated concentration of hydrogen peroxide being within about 10 ppb of a target concentration.

12. The system of claim 11, wherein the control module is capable of calculating the concentration of hydrogen peroxide to be about 2 ppb or less.

13. The system of claim 9, wherein the oxygen removal unit comprises at least one of a vacuum degasification unit, a gas transfer membrane, an oxygen scavenging media, and a vacuum mechanical agitation unit.

14. The system of claim 9, wherein the hydrogen peroxide removal unit comprises a catalyst-driven hydrogen peroxide removal unit.

15. The system of claim 14, wherein the catalyst-driven hydrogen peroxide removal unit comprises at least one of a heterogeneous catalyst comprising palladium-doped anion exchange resin, a heterogeneous catalyst comprising platinum immobilized on a substrate, and a homogeneous catalyst comprising an enzyme.