Claims

1. A system for producing a mixed aqueous halide solution having at least two distinct halide species, comprising:

(i) a first storage tank (16), the first storage tank (16) is configured to contain an aqueous halide solution, and wherein the aqueous halide solution is devoid of chlorine;

(ii) a first mixing tank (20) located downstream of the first storage tank (16), wherein the first mixing tank (20) comprises a flow-impeding structure;

(iii) piping for transporting a stream of an aqueous hypochlorite solution to the first mixing tank (20);

(iv) a second storage tank (4) containing the aqueous hypochlorite solution, wherein the piping is configured to transport the aqueous hypochlorite solution from the second storage (4) tank to the first mixing tank (20), and wherein the second storage tank (4) is located upstream of the first mixing tank (20), or

an *in situ* apparatus for generating the aqueous hypochlorite solution, wherein the piping is configured to transport the aqueous hypochlorite solution from the apparatus, and wherein the apparatus is located upstream of the first mixing tank (20);

(v) a third storage tank (8) for storing a pH adjusting chemical;

(vi) a static mixer (12) for mixing the aqueous hypochlorite solution with the pH adjusting chemical for adjusting the pH to between 10 and 12 before it is piped to the first mixing tank (20);

(vii) a first sensor suite (14), wherein the first sensor suite (14) comprises at least a pH sensor to measure the pH of the pH adjusted aqueous hypochlorite solution before it is transported to the first mixing tank (20);

wherein the flow-impeding structure comprises one or more baffles (22), wherein the baffles (22) are configured to facilitate a thorough mixing of (a) the aqueous hypochlorite solution or the pH adjusted aqueous hypochlorite solution, and (b) the aqueous halide solution devoid of chlorine to produce the mixed aqueous halide solution having at least two distinct halide species;

(viii) a second sensor suite (26) located downstream of the first mixing tank (20), wherein the second sensor suite (26) includes one or more sensors to measure one or more parameters of the mixed aqueous halide solution;

(ix) a fourth storage tank (66), wherein the fourth storage tank (66) is fluidically connected to the second sensor suite (26), and wherein the fourth storage tank (66) is configured to contain a halide stabilizing compound;
(x) piping for transporting the mixed aqueous halide solution and the halide stabilizing compound to a second mixing tank (70); and
(xi) the second mixing tank (70) includes one or more baffles (72) and wherein the baffles (72) are configured to facilitate a thorough mixing of (a) the mixed aqueous halide solution, and (b) the halide stabilizing compound to produce a stabilized mixed aqueous halide solution having at least two distinct halide species.

2. The system according to Claim 1, wherein the aqueous halide solution is a bromide-containing fluid.

3. The system according to Claim 1, wherein the aqueous halide solution includes bromide and iodide.

4. The system according to Claim 1, wherein the parameters are selected from the group consisting of pH, oxidation reduction potential (ORP), UV-Vis absorption profile and combinations thereof.

5. The system according to Claim 1, further comprising a fifth storage tank located downstream of the second mixing tank (70), wherein the stabilized mixed aqueous halide solution is routed to the fifth storage tank.

6. A method for producing a mixed aqueous halide solution having at least two distinct halide species, comprising:

pumping a stream of an aqueous hypochlorite solution to a first mixing tank (20);

pumping an aqueous halide solution into the first mixing tank (20), wherein the aqueous halide solution is devoid of chlorine; and

facilitating a thorough mixing in the first mixing tank (20) of the aqueous hypochlorite solution and the aqueous halide solution devoid of chlorine to produce the mixed aqueous halide solution having at least two distinct halide species; and
further comprising measuring:

(i) at least a pH of the aqueous hypochlorite solution before it is transported to the first mixing tank (20); and

(ii) one or more parameters of the mixed aqueous halide solution, wherein the parameters are selected from the group consisting of pH, oxidation reduction potential (ORP), UV-Vis absorption profile and combinations thereof;

adjusting the pH of the aqueous hypochlorite solution with a pH adjusting chemical to a pH between 10 and 12 before it is transported to the first mixing tank (20); and

piping for transporting the mixed aqueous halide solution and the halide stabilizing compound to a second mixing tank (70);

the second mixing tank (70) includes one or more baffles and wherein the baffles facilitate a thorough mixing of (a) the mixed aqueous halide solution, and (b) the halide stabilizing compound to produce a stabilized mixed aqueous halide solution having at least two distinct halide species.

7. The method according to Claim 6, further comprising processing the measurements to control a flow rate of the aqueous hypochlorite solution to the first mixing tank (20).

8. The method according to Claim 6, further comprising processing the measurements to control a pumping rate of the aqueous hypochlorite solution and/or the aqueous halide solution to control the reaction between hypochlorite ions and non-chloride halide ions.