Claims:

1. A method for operating an acid gas treatment unit with reduced corrosion comprising:

(a) contacting an acid gas stream containing H2S with an aqueous alkaline absorbent solution to absorb the H2S into the solution to form a stream including HS- and/or S2- ions;

(b) contacting the stream containing the HS- and/or S2- ions with elemental sulfur to react the sulfur with the HS- and/or S2- ions to generate polysulfide ions, and

(c) regenerating the aqueous alkaline absorbent solution to release acid gas components from the solution, while operating with an accumulation of heat stable salts exceeding 3 wt. percent.

2. The method of claim 1 wherein the aqueous alkaline absorbent solution includes at least one of alkanolamine, a metal hydroxide, a metal carbonate, a metal hydrated oxide, a metal bicarbonate, ammonium or amine cations, or a mixture thereof.

~~3. The method according to anyone of the preceding claims, wherein the aqueous amine absorbent solution comprises an alkanolamine or an amine, or a mixture thereof.~~

3. The method of claim 2 wherein the aqueous alkaline absorbent solution includes an amine component, the amine component having an amine strength of at least 5%.

4. The method according to claim ~~3,~~ 1 wherein the aqueous alkaline absorbent solution includes an alkanolamine.

5. The method ~~according to~~ of claim 4, wherein the alkanolamine is selected from monoethanolamine (MEA), diethanolamine (DEA), triethanolamine (TEA),

dipropanolamine (DPA), diisopropanolamine (DIPA), methyldiethanolamine (MDEA), and diethylmonoethanolamine (DEAE).

6. The method ~~according to anyone of the preceding claims,~~ of claim 1 wherein the acid gas stream further comprises ~~H2S and~~ at least one of CO2, SO2, SO3, CS2, HCN, COS and a C1-C4 thiol.

7. The method ~~according to anyone of the preceding claims~~ of claim 1, wherein the aqueous alkaline absorbent solution is contained in an acid gas treatment unit having a ~~carbon~~ low alloy steel surface, the method further comprising:

allowing the polysulfide ions to contact the metal surface of the acid gas treatment unit to form ~~iron~~ metal-polysulfide on the ~~steel~~ metal surface, thereby ameliorating corrosion of the unit.

8. The method ~~according to anyone of the preceding claims~~ of claim 1, wherein the acid gas stream includes mercury, the method further comprising:

allowing the polysulfide ions to remain in the aqueous alkaline absorbent solution to react with the mercury to form mercury sulfide; and

filtering the mercury sulfide from the aqueous alkaline absorbent solution stream.

9. The method ~~according to anyone of claims 1-8~~ of claim 1, wherein the acid gas stream includes cyanide ions, the method further comprising:

allowing the polysulfide ions to remain in the aqueous alkaline absorbent solution to react with the cyanide ions to form thiocyanate ions, thereby reducing the concentration of the cyanide ions in the acid gas stream and creating thiocyanate.

10. The method ~~according to anyone of claims 1-9~~ of claim 1, wherein the acid gas stream includes arsine, the method further comprising:

allowing the polysulfide ions to remain in the aqueous alkaline absorbent solution to react with the arsine to form arsenic trisulfide; and

filtering the arsenic trisulfide from the aqueous alkaline absorbent solution.

11. The method ~~according to anyone of the preceding claims, wherein~~ of claim 1 in which the stream containing the HS- and/or S2- ions which is contacted with the elemental sulfur to the process to generate polysulfide ions is the stream resulting from the step of contacting the acid gas stream with the aqueous alkaline absorbent solution.

~~12. The method of anyone of the preceding claims in which the aqueous alkaline absorbent solution includes monoethanolamine (MEA) at a concentration exceeding 25 wt. percent of the solution.~~

~~13. The method of anyone of the claims 1 to 11 in which the aqueous alkaline absorbent solution includes diethanolamine (DEA) at a concentration exceeding 25 wt. percent of the solution.~~

~~14. The method of anyone of the preceding claims in which the aqueous alkaline absorbent solution includes an alkanolamine selected from monoethanolamine (MEA) or diethanolamine (DEA) and the process stream including HS- and/or S2- ions contains 0.5-0.7 moles acid gas / mole alkanolamine.~~

12. A method for treating a gas stream containing acidic components including H_2S in an acid gas treatment unit with reduced corrosion, which comprises:

(i) contacting the acid gas stream with a lean stream of an aqueous amine absorbent solution to absorb the H2S into the solution to form a rich absorbent solution stream including HS- and/or S2- ions;

(ii) contacting the rich absorbent solution stream containing the HS- and/or S2- ions with elemental sulfur to react the sulfur with the HS- and/or S2- ions to generate polysulfide ions, and

(iii) regenerating the aqueous alkaline absorbent solution to release acid gas components from the solution and form a regenerated stream of lean aqueous amine absorbent while operating with an accumulation of heat stable salts exceeding 3 wt. percent.

13. The method of claim 12 in which the aqueous amine absorbent solution comprises an alkanolamine or an amine, or a mixture thereof.

14. The method of claim 13 in which the aqueous alkaline absorbent solution scrubbing agent solvent includes an alkanolamine.

15. The method of claim 14 in which the alkanolamine is selected from monoethanolamine (MEA), diethanolamine (DEA), triethanolamine (TEA), dipropanolamine (DPA), diisopropanolamine (DIPA), methyldiethanolamine (MDEA), and diethylmonoethanolamine (DEAE).

16. The method of claim 12 in which the aqueous amine absorbent solution has an amine strength of at least 5%.

17. The method of claim 12 in which the aqueous amine absorbent solution is contained in an acid gas treatment unit with a low alloy steel surface and the polysulfide ions contact the steel surface of the unit to form metal-polysulfide on the surface to ameliorate corrosion of the surface.

18. The method of claim 12 in which acid gas stream includes mercury and the polysulfide ions in the aqueous alkaline absorbent solution process stream react with the mercury to form mercury sulfide which is filtered from the absorbent solution stream.

19. The method of claim 12 in which the acid gas process stream includes cyanide ions and the polysulfide ions in the absorbent solution stream react with the cyanide ions to form thiocyanate ions.

20. The method of claim 12 in which the acid gas process stream includes arsine and the polysulfide ions in the aqueous alkaline absorbent solution process stream react with the arsine to form arsenic trisulfide which is filtered from the absorbent solution stream.

21. The method of claim 12 in which the stream containing the HS- and/or S2- ions which is contacted with the elemental sulfur to the process to generate polysulfide ions is the stream resulting from the step of contacting the acid gas stream with the aqueous alkaline absorbent solution.