What is claimed is:

1. A method for treating hydrogen sulfide gas, comprising:

reacting hydrogen sulfide gas with iodine to produce a stream comprising iodide and sulfur;

removing sulfur from the stream to produce a separated stream comprising iodide; and

reacting the separated stream comprising iodide with a source of oxygen under aqueous conditions and at a predetermined temperature and a predetermined pressure to produce a stream comprising iodine.

2. The method of claim 1, further comprising recovering at least a portion of the iodine from the stream comprising iodine.

3. The method of claim 2, further comprising introducing at least a portion of the regenerated iodine to the hydrogen sulfide gas.

4. The method of claim 1, further comprising recovering elemental sulfur from the stream comprising iodide and sulfur.

5. The method of claim 1, wherein the source of oxygen is air.

6. The method of claim 1, wherein the predetermined temperature is in a range of from ~~about~~ 75 °C to ~~about~~ 260 °C.

7. The method of claim 6, wherein the predetermined temperature is in a range of from ~~about~~ 120 °C to ~~about~~ 175 °C.

8. The method of claim 1, wherein the predetermined pressure is in a range of from ~~about~~ 25 psi to ~~about~~ 2000 psi.

9. The method of claim 8, wherein the predetermined pressure is in a range of from ~~about~~ 100 psi to ~~about~~ 400 psi.

10. The method of claim 1, further comprising reacting the separated stream comprising iodide with a source of oxygen under aqueous conditions for a time period in a range of from ~~about~~ 15 minutes to ~~about~~ 120 minutes.

11. The method of claim 10, wherein the time period is less than ~~about~~ 15 minutes.

12. The method of claim 1, further comprising recovering thermal energy from the stream comprising iodine.

13. A system for treating hydrogen sulfide gas, comprising:
a contactor fluidly connected to a source of hydrogen sulfide gas and a source of iodine;
a separator fluidly connected downstream from the contactor and configured to separate elemental sulfur and iodide; and
a reactor fluidly connected downstream from the separator and the separated iodide and fluidly connected to a source of oxygen.

14. The system of claim 13, further comprising a control system configured to regulate a predetermined temperature and predetermined pressure of the reactor.

15. The system of claim 13, further comprising at least one scrubber fluidly connected downstream from the reactor and upstream from the source of iodine.

16. The system of claim 13, further comprising at least one energy recovery device fluidly connected downstream from the reactor and upstream from the contactor and configured to recover thermal energy from the reactor.

17. The system of claim 13, further comprising a reactor outlet fluidly connected upstream from the contactor and configured to transfer at least a portion of regenerated iodine from the reactor to the contactor.

18. The system of claim 17, wherein the rate of regeneration from iodide to regenerated iodine from the reactor is at least 50%.

19. The system of claim 13, further comprising a scrubber fluidly connected downstream from the reactor and configured to transfer at least a portion of regenerated iodine from the reactor to the contactor.