CLAIMS

1. A system for ammonia purification, which comprises:

a caustic scrubber in fluid communication with a feed gas stream, a caustic solution stream, a first ammonia vapor stream and a second ammonia vapor stream for producing a scrubbed ammonia stream and a spent caustic stream;

a compression train system with at least two compression stages for separating the scrubbed ammonia stream into a non-condensable vapor stream and an anhydrous ammonia liquid product stream;

an ammonia stripper for separating a sour water liquid stream into the first ammonia vapor stream and a liquid effluent stream; and

a caustic fractionator in fluid communication with the spent caustic stream for producing a liquid bottom stream and an overhead vapor stream.

2. The system of claim 1, wherein the compression train system comprises:

a first stage compressor suction drum for separating the scrubbed ammonia stream into a wastewater liquid stream and a caustic vapor stream;

a first stage ammonia compressor for raising the pressure of the caustic vapor stream;

a first stage heat exchanger downstream of the first stage ammonia compressor for cooling the caustic vapor stream;

a second stage compressor suction drum downstream of the first stage heat exchanger for separating the caustic vapor stream into a third ammonia vapor stream and the sour water liquid stream;

a second stage ammonia compressor for raising the pressure of the third ammonia vapor stream;

a second stage heat exchanger downstream of the second stage ammonia compressor for cooling the third ammonia vapor stream; and

an ammonia separator downstream of the second stage heat exchanger for separating the third ammonia vapor stream into the non-condensable vapor stream and the anhydrous ammonia liquid product stream.

3. The system of claim 1, wherein the caustic solution stream comprises about 1 wt% NaOH to about 50 wt% NaOH in water.

4. The system of claim 1, wherein the caustic solution stream comprises greater than 50 wt% NaOH in water.

5. The system of claim 1, wherein the caustic solution stream comprises about 1 wt% KOH to about 50 wt% KOH in water.

6. The system of claim 1, wherein the caustic solution stream comprises greater than 50 wt% KOH in water.

7. The system of claim 2, further comprising a pre-stage heat exchanger in fluid communication with the scrubbed ammonia stream and upstream of the first stage compressor suction drum.

8. The system of claim 7, further comprising liquid water stream in fluid communication with the scrubbed ammonia stream and upstream of the pre-stage heat exchanger.

9. The system of claim 7, wherein the pre-stage heat exchanger, the first stage heat exchanger and the second stage heat exchanger each comprise an air-cooled condenser cooler.

10. The system of claim 1, further comprising an independent live steam stream in fluid communication with the ammonia stripper.

11. A method for ammonia purification, which comprises:

introducing a feed gas stream, a caustic solution stream, a first ammonia vapor stream and a second ammonia vapor stream into a caustic scrubber for producing a scrubbed ammonia stream and a spent caustic stream;

separating the scrubbed ammonia stream into a sour water liquid stream, a non-condensable vapor stream and an anhydrous ammonia liquid product stream;

separating the sour water liquid stream into the first ammonia vapor stream and a liquid effluent stream; and

introducing the spent caustic stream a caustic fractionator for producing a liquid bottom stream and an overhead vapor stream.

12. The method of claim 11, wherein the scrubbed ammonia stream is separated into the non-condensable vapor stream and the anhydrous ammonia liquid product stream by a compression train system with at least two compression stages.

13. The method of claim 11, wherein the sour water liquid stream is separated into the first ammonia vapor stream and the liquid effluent stream by an ammonia stripper.

14. The method of claim 11, wherein the caustic solution stream comprises about 1 wt% NaOH to about 50 wt% NaOH in water.

15. The method of claim 11, wherein the caustic solution stream comprises greater than 50 wt% NaOH in water.

16. The method of claim 11, wherein the caustic solution stream comprises about 1 wt% KOH to about 50 wt% KOH in water.

17. The method of claim 11, wherein the caustic solution stream comprises greater than 50 wt% KOH in water.

18. The method of claim 12, further comprising introducing liquid water stream into the compression train system at one of a position upstream of the at least two compression stages and a position downstream one of the at least two compression stages.

19. The method of claim 13, further comprising introducing an independent live steam stream into the ammonia stripper.

20. A system for ammonia purification, which comprises:

a caustic scrubber in fluid communication with a feed gas stream, a caustic solution stream, a first ammonia vapor stream and a second ammonia vapor stream for producing a scrubbed ammonia stream and a spent caustic stream;

a compression train system with at least two compression stages for separating the scrubbed ammonia stream into a non-condensable vapor stream and an anhydrous ammonia liquid product stream;

an ammonia stripper for separating a sour water liquid stream into the first ammonia vapor stream and a liquid effluent stream;

a caustic fractionator in fluid communication with the spent caustic stream for producing a liquid bottom stream and an overhead vapor stream;

a condenser in fluid communication with the overhead vapor stream for producing a two-phase stream comprising water and ammonia; and

a reflux drum for separating the two-phase stream into a liquid water stream and the second ammonia vapor stream.

21. A method for ammonia purification, which comprises:

introducing a feed gas stream, a caustic solution stream, a first ammonia vapor stream and a second ammonia vapor stream into a caustic scrubber for producing a scrubbed ammonia stream and a spent caustic stream;

separating the scrubbed ammonia stream into a sour water liquid stream, a non-condensable vapor stream and an anhydrous ammonia liquid product stream;

separating the sour water liquid stream into the first ammonia vapor stream and a liquid effluent stream;

introducing the spent caustic stream a caustic fractionator for producing a liquid bottom stream and an overhead vapor stream;

introducing the overhead vapor stream into a condenser for producing a two-phase stream comprising water and ammonia; and

separating the two-phase stream into a liquid water stream and the second ammonia vapor stream.