CLAIMS

1. A system for ammonia purification, which comprises:

an ammonia stripper configured to separate a sour water feed stream comprising ammonia and hydrogen sulfide into an ammonia stripper vapor stream and an ammonia stripper liquid stream;

a first heat exchanger positioned upstream of the ammonia stripper and enclosing a portion of the sour water feed stream and a portion of the ammonia stripper liquid stream, the first heat exchanger is configured to heat the sour water feed stream and cool the ammonia stripper liquid stream to produce a stripped water stream;

a second heat exchanger configured to convert the ammonia stripper vapor stream to a two-phase ammonia stream;

a knock-out drum configured to separate the two-phase ammonia stream into an ammonia vapor stream and an ammonia liquid stream; and

a water wash configured to remove hydrogen sulfide and carbon dioxide from the ammonia vapor stream and producing a purified ammonia vapor stream and a rich water stream comprising hydrogen sulfide and carbon dioxide.

2. The system of claim 1, wherein the sour water feed stream includes a higher concentration of the ammonia than the hydrogen sulfide.

3. The system of claim 1 or 2, wherein a portion of the rich water stream is fluidly connected to a hydrogen sulfide stripper.

4. The system of claim 3, further comprising a third heat exchanger configured to chill another portion of the rich water stream recycled back to the water wash.

5. The system of claim 4, further comprising a fourth heat exchanger configured to chill the stripped water stream with a coolant to produce a chilled stripped water stream.

6. The system of claim 5, wherein the chilled stripped water stream is fluidly connected to at least one of the water wash and a hydrogen sulfide stripper.

7. The system of claim 6, wherein the hydrogen sulfide stripper is fluidly connected to the chilled stripped water stream, the hydrogen sulfide stripper is configured to remove hydrogen sulfide and carbon dioxide from the portion of the rich water stream and producing a vapor stream comprising hydrogen sulfide and carbon dioxide, and a liquid stream comprising ammonia and residual hydrogen sulfide and carbon dioxide.

8. The system of claim 7, further comprising another knock-out drum configured to remove entrained droplets from the vapor stream and producing a purified acid gas stream.

9. The system of claim 7 or 8, wherein the liquid stream is in fluid communication with the sour water feed stream.

10. The system of claim 6, wherein the chilled stripped water stream is fluidly connected to the water wash and the ammonia vapor stream is fluidly connected to the water wash below the chilled stripped water stream and above the rich water stream.

11. The system of any preceding claim, wherein a portion of the ammonia liquid stream is fluidly connected to the ammonia stripper and another portion of the ammonia liquid stream is in fluid communication with the sour water feed stream.

12. A method for ammonia purification, which comprises:

heating a sour water feed stream comprising ammonia and hydrogen sulfide in a heat exchanger using an ammonia stripper liquid stream to produce a heated sour water feed stream;

cooling the ammonia stripper liquid stream in the heat exchanger using the sour water feed stream to produce a stripped water stream;

separating the heated sour water feed stream in an ammonia stripper into an ammonia stripper vapor stream and the ammonia stripper liquid stream;

converting the ammonia stripper vapor stream to a two-phase ammonia stream;

separating the two-phase ammonia stream into an ammonia vapor stream and an ammonia liquid stream; and

removing hydrogen sulfide and carbon dioxide from the ammonia vapor stream to produce a purified ammonia vapor stream and a rich water stream comprising hydrogen sulfide and carbon dioxide.

13. A system for ammonia purification, which comprises:

an ammonia stripper configured to separate a sour water feed stream comprising ammonia and hydrogen sulfide into an ammonia stripper vapor stream and an ammonia stripper liquid stream;

a first heat exchanger positioned upstream of the ammonia stripper and enclosing a portion of the sour water feed stream and a portion of the ammonia stripper liquid stream, the first heat exchanger configured to heat the sour water feed stream and cooling the ammonia stripper liquid stream to produce a stripped water stream;

a cooler configured to cool another ammonia stripper liquid stream withdrawn from the ammonia stripper above the ammonia stripper liquid stream;

a pump configured to pump a portion of the another ammonia stripper liquid stream back to the ammonia stripper; and

a water wash configured to remove hydrogen sulfide and carbon dioxide from the ammonia stripper vapor stream and producing a purified ammonia vapor stream and a rich water stream comprising hydrogen sulfide and carbon dioxide.

14. A method for ammonia purification, which comprises:

heating a sour water feed stream comprising ammonia and hydrogen sulfide in a heat exchanger using an ammonia stripper liquid stream to produce a heated sour water feed stream;

cooling the ammonia stripper liquid stream in the heat exchanger using the sour water feed stream to produce a stripped water stream;

separating the heated sour water feed stream in an ammonia stripper into an ammonia stripper vapor stream and an ammonia stripper liquid stream;

withdrawing another ammonia stripper liquid stream from the ammonia stripper;

cooling the another ammonia stripper liquid stream; and

removing hydrogen sulfide and carbon dioxide from the ammonia stripper vapor stream to produce a purified ammonia vapor stream and a rich water stream comprising hydrogen sulfide and carbon dioxide.

15. The method of claim 14, wherein the heated sour water feed stream is separated into the ammonia stripper vapor stream and the ammonia stripper liquid stream using another portion of the another ammonia stripper liquid stream.