CLAIMS:

1. A method for processing a pyrolysis effluent, comprising:

passing a pyrolysis effluent comprising a temperature of 300°C or less to a fractionation column, wherein the fractionation column includes,

(a) a lower region,

(b) a pump-around region located above the lower region, wherein the pump-around region includes one or more vapor-liquid contactors,

(c) a vapor-distribution region located above the pump-around region, ~~wherein the vapor-distribution region,~~ and

(d) a fractionation region located above the vapor-distribution region, wherein the fractionation region includes one or more vapor-liquid contactors; and the pump-around region is located below the first fractionation tray in the fractionation column;

introducing the pyrolysis effluent into the lower region;

withdrawing a fluid stream from the lower region;

conducing at least a vapor from the lower region upward through the pump-around region to distribute the vapor;

conducting the distributed vapor upward into the vapor-distribution region and toward the fractionation region;

cooling at least a portion of the withdrawn fluid stream, and introducing at least a portion of the cooled fluid stream into the vapor-distribution region;

disengaging in the fractionation region a substantially liquid phase from the distributed vapor phase, passing at least a remainder of the distributed vapor phase upward away from the fractionation region, and conducting at least a portion of the disengaged liquid out of the fractionation column.

2. The method of claim 1, wherein the vapor-liquid contactors of the fractionation region include a lower vapor-liquid contactor for receiving distributed vapor from the vapor-distribution region, wherein the lower vapor-liquid contactor has a temperature of ≤ 140°C.

3. The method of claim 1 or 2, further comprising introducing a naphtha boiling range fraction into the fractionation tower above the fractionation region.

4. The method of claim 3, further separating from the remainder of the distributed vapor phase a naphtha boiling range fraction and a fourth fraction having a lower boiling point than the naphtha boiling range fraction.

5. The method of any of claims 2 – 4, wherein the pyrolysis effluent fraction has a temperature of 250°C or less, and/or wherein the lower fractionation tray has a temperature in a range of from 100°C to 140°C.

6. The method of any of claims 1 – 5, wherein the pyrolysis effluent comprises at least a portion of a steam cracking effluent.

7. The method of claim 6, further comprising:

performing steam cracking on a liquid steam cracking feedstock;

quenching the steam cracking effluent; and

separating a pyrolysis tar from the quenched steam cracking before introducing the quenched steam cracker effluent into the fractionation column as the pyrolysis effluent.

8. The method of claim 7, further comprising cooling the steam cracking effluent before separating the pyrolysis tar.

9. The method of claim 6, the method further comprising:

performing steam cracking on a liquid steam cracking feedstock to form a steam cracking effluent;

quenching the steam cracking effluent; and

cooling the quenched steam cracking effluent, and passing the cooled steam cracking effluent fraction into the fractionation column.

10. The method of claim 9, the method further comprising:

separating a tar stream from the fluid stream withdrawn from the lower region.

11. The method of any of claims 1 – 10, wherein the pump-around region includes at least one chimney tray below the vapor-liquid contactors of the pump-around region.

12. The method of any of claims 1 – 11, wherein the liquid disengaged in the fractionation region comprises a gas oil fraction.

13. The method of any of claims 1, further comprising recovering water and/or naphtha from at least a portion of the remainder of the vapor phase conducted upward away from the fractionation region.

14. A primary fractionator for a pyrolysis reaction system, comprising:

a fractionator tower comprising a fractionator inlet, an intermediate outlet, a pump-around outlet located below the intermediate outlet, and an overhead outlet;

one or more fractionation trays, the one or more fractionation trays being in fluid communication with the intermediate outlet;

a pump-around section comprising one or more pump-around trays located below the one or more first fractionation trays, wherein the pump-around section is located below the first fractionation tray in the fractionation column; and

a pump-around loop providing fluid communication between the pump-around outlet and the pump-around section, the pump-around loop comprising a heat exchanger,

wherein the fractionator inlet is located below the one or more pump-around trays.

15. The primary fractionator of claim 14, further comprising a reflux inlet located below the overhead outlet and above the one or more fractionation trays.

16. The primary fractionator of claim 15, wherein the reflux inlet is in indirect fluid communication with the overhead outlet via a separation stage.

17. The primary fractionator of any of claims 14 – 16, further comprising one or more vapor distribution devices located below the one or more pump-around trays.

18. The primary fractionator of any of claims 14 – 17, wherein the one or more fractionation trays comprise a gas oil product, the gas oil product comprising a temperature of 140°C or less.

19. The primary fractionator of any of claim 14 – 18, wherein the fractionation tower further comprises a bottoms outlet, the pump-around outlet being located between the bottoms outlet and the intermediate outlet.

20. A system for processing a pyrolysis effluent, comprising:

a pyrolysis reactor comprising a pyrolysis effluent outlet;

a quench stage comprising a quench stage inlet in fluid communication with the pyrolysis effluent outlet, a quench oil inlet, and a quench stage outlet;

a pre-cooler comprising a pre-cooler inlet in fluid communication with the quench stage outlet, and a pre-cooler outlet; and

a primary fractionator comprising:

a fractionator tower comprising a fractionator inlet, an intermediate outlet, a pump-around outlet located below the intermediate outlet, and an overhead outlet;

one or more fractionation trays, the one or more fractionation trays being in fluid communication with the intermediate outlet;

a pump-around section comprising one or more pump-around trays located below the ~~one or more~~ first fractionation ~~trays~~ tray; and

a pump-around loop providing fluid communication between the pump-around outlet and the pump-around section, the pump-around loop comprising a heat exchanger,

wherein the fractionator inlet is located below the one or more first pump-around trays.

21. The system of claim 20, further comprising a naphtha separation stage comprising a separation inlet in fluid communication with the overhead outlet, a naphtha outlet, and a gas outlet.

22. The system of claim ~~20 or~~ 21, further comprising a reflux inlet located below the overhead outlet and above the one or more fractionation trays, the naphtha outlet being in fluid communication with the reflux inlet.

23. The system of any of claims 20 – 22, further comprising a tar separation stage, the tar separation stage comprising a tar separation inlet in fluid communication with the quench stage outlet, a tar outlet, and a product outlet in fluid communication with the pre-cooler inlet.

24. The system of any of claims 20 – 22, further comprising a tar separation stage, the tar separation stage comprising a tar separation inlet in fluid communication with the pump-around outlet, a tar outlet, and a product outlet.

25. The system of any of claims 20 – 24, wherein the quench oil inlet is in fluid communication with the pump-around outlet.