CLAIMS:

What is claimed is:

1. A furnace effluent upgrading process, comprising:

contacting the furnace effluent with a first quench liquid to produce a quenched mixture, wherein (i) at least a portion of the furnace effluent is produced in a steam cracking furnace, (ii) the furnace effluent comprises coke and/or tar, and (iii) the first quench liquid comprises one or more of a first steam cracker naphtha, a first steam cracker gas oil, and a first steam cracker quench oil;

introducing the quenched mixture into a first inlet of a centrifugal separator;

separating a vapor product and a centrifugal separator bottoms from the quenched mixture, wherein the centrifugal separator bottoms comprises at least a portion of the coke and/or at least a portion of the tar; and

recovering the centrifugal separator bottoms from a first outlet of the centrifugal separator.

2. The process of claim 1, further comprising introducing a second quench liquid, wherein the second quench liquid comprises one or more of a second steam cracker naphtha, a second steam cracker gas oil, and a second steam cracker quench oil into a second inlet of the centrifugal separator at a second quench liquid flow rate.

3. The process of claim 1 or claim 2, further comprising introducing a recycle portion of the centrifugal separator bottoms tangentially onto a frustoconical inner wall of the centrifugal separator through a recycle fluid inlet of the centrifugal separator.

4. The process of claim 3, wherein the frustoconical inner wall is at an angle of 45° to 80° with respect to a base of the frustoconical inner wall.

5. The process of claim 3 or 4, further comprising measuring a mass flow rate of the centrifugal separator bottoms at a location between the first outlet and the recycle inlet.

6. The process of claim 5, further comprising increasing the flow rate (mass basis) of the second quench liquid when the centrifugal separator bottoms' mass flow rate and/or velocity is ≤ 90% of that achieved with maximum recycle of clean bottoms material.

7. The process of any of claims 3 to 6, further comprising controlling the mass flow rate of the second quench liquid to maintain a predestined solids content of ≤ 0.9 wt. % in the centrifugal separator bottoms.

8. The process of any of claims 1 to 7, further comprising recovering the vapor product from a second outlet of the centrifugal separator.

9. The process of any of claims 1 to 8, wherein (i) the furnace effluent includes a decoke effluent and (ii) the furnace effluent is at a temperature of 180°C to 400°C when the furnace effluent is contacted with the first quench liquid.

10. The process of any of claims 1 to 9, wherein the first quench liquid is at a temperature of 30°C to 200°C when the furnace effluent is contacted with the first quench liquid.

11. The process of any of claims 2 to 10, wherein the first quench liquid and the second quench liquid each comprise ≤ 1 wt. % of water based on the weight of the first quench liquid or second quench liquid, respectively.

12. A process for removing coke, tar, or a mixture thereof from a furnace effluent comprising:

contacting a furnace effluent comprising coke and/or tar, with a first quench liquid to produce a partially-quenched mixture, wherein at least a portion of the furnace effluent is produced in a steam cracking furnace, and the first quench liquid comprises one or more of a first steam cracker naphtha, a first steam cracker gas oil, and a first steam cracker quench oil;

introducing the partially-quenched mixture into a first inlet of a centrifugal separator;

combining the partially quenched mixture in the centrifugal separator and a second quench liquid to produce a quenched mixture, the second quench liquid being introduced into a second inlet of the centrifugal separator at a second quench liquid mass flow rate, wherein the second

quench liquid comprises one or more of a second steam cracker naphtha, a second steam cracker gas oil, and a second steam cracker quench oil;

separating a vapor product and a centrifugal separator bottoms from the quenched mixture, wherein the centrifugal separator bottoms comprises at least a portion of the coke and/or at least a portion of the tar;

recovering the centrifugal separator bottoms from a first outlet of the centrifugal separator;

recycling at least a portion of the centrifugal separator bottoms tangentially onto a frustoconical inner wall of the centrifugal separator through a recycle inlet of the centrifugal separator;

measuring a centrifugal separator bottoms mass flow rate at a location between the first outlet and the recycle inlet; and

increasing the flow rate of the second quench liquid when the centrifugal separator bottoms mass flow rate is ≤ 90% of maximum recycle rate with clean bottoms material.

13. The process of claim 12, wherein the frustoconical inner wall is at an angle of 45° to 80° with respect to a base of the frustoconical inner wall.

14. The process of claim 12 or 13, wherein the centrifugal separator is a centrifugal separator drum, and wherein the process further comprising recovering the vapor product from a second outlet of the centrifugal separator.

15. The process of any of claims 12 to 14, wherein (i) the furnace is undergoing on-stream decoking, (ii) the furnace effluent includes decoking effluent, and (iii) the furnace effluent is at a temperature of 180°C to 400°C when the furnace effluent is contacted with the first quench liquid.

16. The process of any of claims 12 to 15, wherein the first quench liquid is at a temperature of 30°C to 200°C when the furnace effluent is contacted with the first quench liquid.

17. The process of any of claims 12 to 16, wherein the flow rate of the second quench liquid is adjusted to maintain a solids content of ≤ 0.9 wt. % in the centrifugal separator bottoms.

18. The process of claim 17, wherein the flow rate of the second quench liquid is adjusted to maintain a solids content between 0.4 wt. % and 0.9 wt. % in the centrifugal separator bottoms.

19. The process of any of claims 12 to 18, wherein the first and second quench liquid and the centrifugal separator bottoms each comprise ≤ 1 wt. % of water based on the weight of the first quench liquid, second quench liquid, or bottoms flow, respectively.

20. An apparatus comprising:

a separator having an internal volume and comprising a separation section having a cylindrical inner wall disposed toward a first end of the separator and a discharge section having a frustoconical inner wall disposed toward a second end of the separator, wherein the frustoconical inner wall has an angle of 45° to 80° with respect to a base of the frustoconical inner wall;

a first outlet, a second outlet, a first inlet, a second inlet, and a recycle fluid inlet in fluid communication with the internal volume, wherein the first outlet and the first inlet are disposed toward the first end of the separator, the second inlet and the second outlet are disposed toward the second end of the separator, and the recycle fluid inlet is disposed on the frustoconical inner wall,

a first flow meter in fluid communication with the second inlet and configured to measure a first flow rate, and

a recycle fluid flow meter in fluid communication with the recycle fluid inlet and configured to measure a recycle fluid flow rate.

21. The apparatus of claim 20, wherein (i) the recycle fluid inlet is in fluid communication with the second outlet, and (ii) the first inlet is configured to receive a quenched steam cracker effluent from a steam cracker operating in on-stream decoking mode.

22. The apparatus of claim 20 or claim 21, further comprising a tar and coke discharge system in fluid communication with the second outlet.

23. The apparatus of any of claims 20 to 22, further comprising a first valve in fluid communication with the second inlet, wherein the first valve is configured to increase the first flow

rate when the recycle fluid flow rate is ≤ 90% of maximum recycle rate with clean bottoms material recycled.

24. The apparatus of any of claims 20 to 23, further comprising at least one pump in fluid communication with the second outlet and the recycle fluid inlet.

25. A process for upgrading a furnace effluent from a steam cracker operating in on-stream decoking mode, the process comprising:

contacting the furnace effluent with a first quench liquid to produce a quenched mixture, wherein the first quench liquid comprises a first steam cracker naphtha, a first steam cracker gas oil, a first steam cracker quench oil, or a mixture thereof and the furnace effluent is at temperature of 180°C to 400°C and the first quench liquid is at a temperature of 30°C to 200°C when the furnace effluent is contacted with the first quench liquid, wherein the furnace effluent comprises coke, tar, or the mixture thereof;

introducing the quenched mixture into a first inlet of a centrifugal separator drum;

introducing a second quench liquid comprising a second steam cracker naphtha, a second steam cracker gas oil, a second steam cracker quench oil, or a mixture thereof into a second inlet of the centrifugal separator drum at a second quench liquid flow rate, wherein the centrifugal separator drum contains the quenched mixture;

separating a vapor product and a centrifugal drum bottoms from the quenched mixture and second quenched liquid, wherein the centrifugal drum bottoms comprises at least a portion of the coke, tar, or the mixture thereof;

recovering the centrifugal drum bottoms from a first outlet of the centrifugal separator drum;

introducing a recycle fluid tangentially onto a frustoconical inner wall of the centrifugal separator drum through a recycle fluid inlet of the centrifugal separator drum, wherein the recycle fluid comprises at least a portion of the centrifugal separator drum bottoms;

measuring a centrifugal separator drum bottoms flow rate between the first outlet and the recycle fluid inlet; and

increasing the flow rate of the second quench liquid when the centrifugal separator drum bottoms flow rate is ≤ 90% of maximum recycle rate with clean bottoms material recycled.