

CLAIMS

What is claimed is –

1. A process for making olefins and a cracked gasoline stream, said process comprising:

5 (a) cracking a cracker feed stream comprising a recycle content pyrolysis oil composition (r-pyoil) and a non-recycle content C2 to C4 composition in a cracker furnace to provide an olefin-containing effluent stream; and

(b) separating said olefin-containing effluent stream in at least one separator downstream of said cracker furnace to provide a light fraction and a heavy fraction, wherein said heavy fraction comprises a recycle content cracked gasoline composition (r-pyrolysis gasoline).
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2. A process for making olefins and a cracked gasoline stream, said process comprising:

15 (a) separating a column feed stream in at least one separator to provide a light fraction and a heavy fraction, wherein said column feed stream comprises a recycle content hydrocarbon composition (r-hydrocarbon); and

(b) recovering a product stream comprising recycle content cracked gasoline composition (r-pyrolysis gasoline) from said heavy fraction.
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3. A composition comprising a recycle content pyrolysis gasoline composition (r-pyrolysis gasoline) formed by the process of any of claims 1 and 2 above.

25 4. A system for carrying out the process of any of claims 1 or 2.

5. The process, system or composition of any of claims 1-4, further comprising a recovering an olefin stream comprising a recycle content olefin (r-olefin) from said light fraction.
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6. The process, system or composition of any of claims 1-5, wherein said r-olefin comprises predominantly r-ethylene.

7. The process, system or composition of any of claims 6, wherein said r-olefin comprises predominantly r-propylene.

5 8. The process, system or composition of any of claims 1-2, wherein the mass flow rate of dienes in said heavy fraction is at least 0.1% higher than the mass flow rate of dienes in said heavy fraction if the cracker feed stream did not include r-pyoil, but at the same flow rate and all other conditions being identical.

10 9. The process, system or composition of any of claims 8, wherein the mass flow rate of dienes in said heavy fraction is at least 0.1% higher than the mass flow rate of dienes in said heavy fraction if the column feed stream did not include r-hydrocarbon, but at the same flow rate.

15 10. The process, system or composition of any of claims 9, wherein said r-pyrolysis gasoline is present in said heavy fraction in an amount at least 1 and/or not more than 99 weight percent, based on the total weight of said heavy fraction.

20 11. The process, system or composition of any of claims 10, wherein said heavy fraction comprises dienes in an amount of at least 0.01 weight percent, based on the total weight of said heavy fraction.

12. The process, system or composition of any of claims 11, wherein said dienes comprise C4 to C12 dienes.

25 13. The process, system or composition of any of claims 12, wherein said dienes comprise straight chain dienes, cyclic dienes, or combinations thereof.

30 14. The process, system or composition of any of claims 13, wherein said dienes comprise butadiene, cyclopentadiene, dicyclopentadiene, and combinations thereof.

15. The process, system or composition of any of claims 1, wherein at least 5 percent of the total amount of dienes comprise butadiene.

5 16. The process, system or composition of any of claims 1, wherein at least 5 percent of the total amount of dienes comprise cyclopentadiene.

17. The process, system or composition of any of claims 16, wherein at least 5 percent of the total amount of dienes comprise dicyclopentadiene.

10 18. The process, system or composition of any of claims 17, wherein said composition comprises at least 1 and/or not more than 99 weight percent of said r-pyrolysis gasoline, based on the total weight of said composition.

15 19. The process, system or composition of any of claims 18, further comprising separating said heavy fraction in a column to form a light gasoline stream and a heavy gasoline stream, wherein at least one of the light gasoline stream and the heavy gasoline stream comprise at least a portion of said r-pyrolysis gasoline.

20 20. The process, system or composition of any of claims 19, further comprising at least a portion of said light gasoline stream and/or said heavy gasoline stream to form a hydrocarbon product.

25 21. The process, system or composition of any of claims 20, wherein said hydrocarbon product is selected from the group consisting of a fuel, a polymer, a plasticizer, and combinations thereof.

30 22. The process, system or composition of any of claims 21, wherein the ratio of the mass flow rate of the feed to the separator to the mass flow rate of the heavy fraction is at least 0.5% lower than the ratio of the mass flow rate of the feed to the separator to the mass flow rate of the heavy fraction when the cracker feed stream does not include r-pyoil but had the same mass flow rate.

23. The process, system or composition of any of claims 1, wherein the separator is a quench tower.

24. The process, system or composition of any of claims 1, wherein the separator is a knockout drum upstream of a compressor.

25. The process, system or composition of any of claims 1, wherein the ratio of the mass flow rate of the feed to the separator to the mass flow rate of the light fraction is at least 0.5% higher than the ratio of the mass flow rate of the feed to the separator to the mass flow rate of the heavy fraction when the cracker feed stream does not include r-pyol but had the same mass flow rate.

26. The process, system or composition of any of claims 25, wherein the separator is a quench tower.

27. The process, system or composition of any of claims 26, wherein the separator is a knockout drum upstream of a compressor.

28. The process, system or composition of any of claims 1, wherein said separator includes at least 1 and/or not more than 10 theoretical or actual separation stages.

29. The process, system or composition of any of claims 1, wherein said separator includes not more than 5 actual or theoretical separation stages.

30. The process, system or composition of any of claims 29, wherein said separator is a knockout drum upstream of at least one stage of a gas compressor for increasing the pressure of the olefin-containing stream.

31. The process, system or composition of any of claims 30, wherein the knockout drum is upstream of the first, second, third, fourth, fifth, sixth, or seventh compression stage of said gas compressor.

32. The process, system or composition of any of claims 31, wherein said separator comprises internals selected from the group consisting of packing, trays, and combinations thereof.

5 33. The process, system or composition of any of claims 32, wherein said separator does not include internals comprising packing, trays, and combinations thereof.

10 34. The process, system or composition of any of claims 33, further comprising, compressing at least a portion of said olefin-containing effluent stream to from a compressed olefin stream, wherein said separating includes passing said olefin-containing effluent stream through a quench tower to form a cooled olefin stream and passing the cooled olefin stream through at least one knockout drum prior to said compression.

15 35. The process, system or composition of any of claims 34, further comprising combining the heavy hydrocarbon streams removed from said quench tower and said knockout drum or drums to form a stream comprising a recycle content pyrolysis gasoline composition (r-pyrolysis gasoline).

20 36. The process, system or composition of any of claims 35, wherein said separating further comprises contacting at least a portion of said olefin-containing effluent with a stream comprising water to cool said olefin-containing effluent stream and provide a cooled olefin effluent.

25 37. The process, system or composition of any of claims 36, wherein said separating includes cooling said olefin-containing effluent stream by at least about 25°C and/or not more than 700°C.

30 38. The process, system or composition of any of claims 37, wherein said separating further comprises separating said olefin-containing stream in a fractionator to form at least one olefin-containing product stream.

39. The process, system or composition of any of claims 38, wherein said fractionator is an ethylene splitter and said olefin-containing product stream comprises ethylene.

5 40. The process, system or composition of any of claims 39, wherein said fractionator is a propylene splitter and said olefin-containing product stream comprises propylene.

10 41. The process, system or composition of any of claims 40, wherein the olefin content of said olefin-containing product stream is at least 50 weight percent and/or not more than 99 weight percent, based on the total weight of the olefin-containing product stream.

15 42. The process, system or composition of any of claims 41, wherein said olefin-containing product stream comprises a recycle content olefin composition (r-olefin).

20 43. The process, system or composition of any of claims 42, wherein the cracking is carried out at an average temperature of at least 700°C and/or not more than 1000°C.

 44. The process, system or composition of any of claims 1, wherein at least 1 weight percent of said r-pyoil is obtained from the pyrolysis of recycled waste.

25 45. The process, system or composition of any of claims 1, wherein not more than 95 weight percent of said r-pyoil is obtained from the pyrolysis of recycled waste.