

CLAIMS

What is claimed is –

1. A process for separating methane and lighter components from an olefin-containing stream, said process comprising:

5 (a) introducing a column feed stream into a demethanizer column, wherein said column feed stream comprises a recycle content C2 to C4 olefin composition (r-C2 to C5 olefin); and

(b) separating said column feed stream in said demethanizer column into an overhead stream enriched in methane and lighter components and a bottoms stream depleted in methane and lighter components,

10 wherein the ratio of the weight of methane and lighter components in said overhead stream to the total weight of ethylene and heavier component in said column feed stream is at least 0.1% higher than if said column feed stream did not include said r-C2 to C4 olefin composition but had the same mass flow rate, all other conditions of said demethanizer column being the same.

2. A process for separating methane and lighter components from an olefin-containing stream, said process comprising:

20 (a) introducing a column feed stream into a demethanizer column, wherein said column feed stream comprises a recycle content C2 to C4 olefin composition (r-C2 to C4 olefin); and

(b) separating said column feed stream into an overhead stream enriched in methane and lighter components and a bottoms stream depleted in methane and lighter components,

25 wherein the mass flow rate of the column feed stream introduced into said demethanizer column is at least 0.1% higher if said column feed stream did not include said r-C2 to C4 olefin composition but had the same mass flow rate, all other conditions being the same.

30 3. A process for separating methane and lighter components from an olefin-containing stream, said process comprising:

(a) introducing a column feed stream into a demethanizer column, wherein said column feed stream comprises a recycle content C2 to C4 olefin composition (r-C2 to C4 olefin); and

(b) separating said column feed stream into an overhead stream enriched in methane and lighter components and a bottoms stream depleted in methane and lighter components,

wherein the volumetric or mass flow rate of C4-C5 within said demethanizer column is at least 0.1% higher than if said column feed stream did not include said r-C2 to C4 olefin composition but had the same mass flow rate, all other conditions being the same.

4. A process for separating methane and lighter components from an olefin-containing stream, said process comprising:

(a) introducing a column feed stream into a demethanizer column, wherein said column feed stream comprises a recycle content C2 to C4 olefin composition (r-C2 to C4 olefin); and

(b) separating said column feed stream into an overhead stream enriched in methane and lighter components and a bottoms stream depleted in methane and lighter components,

wherein the differential pressure across the demethanizer is at least 0.1 % lower than if said column feed stream did not include said r-C2 to C4 olefin composition but had the same mass flow rate, all other conditions being the same.

5. A process for making olefins, said process comprising:

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

(b) separating a column feed stream comprising at least a portion of the olefin-containing effluent in a demethanizer column to provide an overhead stream enriched in methane and lighter components and a bottoms stream depleted in methane and lighter components,

wherein the ratio of the mass flow rate of furnace feed stream to the mass flow rate of said column feed stream is at least 0.1% lower than if said furnace feed stream did not include said r-pyoil, all other conditions being the same.

5 6. A process for making olefins, said process comprising:

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

10 (b) separating a column feed stream comprising at least a portion of the olefin-containing effluent in a demethanizer column to provide an overhead stream enriched in methane and lighter components and a bottoms stream depleted in methane and lighter components,

15 wherein the ratio of the weight of ethylene and heavier components in said overhead stream to the total weight of ethylene and heavier components in said column feed stream is at least 0.1% higher than if said furnace feed stream did not include said r-pyoil but had the same mass flow rate, all other conditions being the same.

7. A process for making olefins, said process comprising:

20 (a) cracking a furnace feed stream comprising a recycle content pyrolysis oil composition (r-pyoil) and a C2 to C4 hydrocarbon-containing composition in a cracking furnace to form an olefin-containing effluent;

25 (b) separating a column feed stream comprising at least a portion of the olefin-containing effluent in a demethanizer column to provide an overhead stream enriched in methane and lighter components and a bottoms stream depleted in methane and lighter components,

wherein the mass flow rate of the column feed stream introduced into said demethanizer column is at least 0.1% lower than if said furnace feed stream did not include said r-pyoil but had the same mass flow rate, all other conditions being the same.

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8. A process for making olefins, said process comprising:

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

(b) separating a column feed stream comprising at least a portion of the olefin-containing effluent in a demethanizer column to provide an overhead stream enriched in methane and lighter components and a bottoms stream depleted in methane and lighter components,

wherein the volumetric or mass flow rate of the liquid within said demethanizer column is at least 0.1% lower than if said furnace feed stream did not include said r-pyoil but had the same volumetric or mass flow rate, all other conditions being the same.

9. A process for making olefins, said process comprising:

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

(b) separating a column feed stream comprising at least a portion of the olefin-containing effluent in a demethanizer column to provide an overhead stream enriched in methane and lighter components and a bottoms stream depleted in methane and lighter components,

wherein the pressure differential across said demethanizer is at least 0.1% higher than if said furnace feed stream did not include said r-pyoil but had the same mass flow rate, all other conditions being the same.

10. A composition comprising a recycle content C2 to C4 olefin composition (r-C2 to c4 olefin) formed by the process of any of claims 1-9.

11. A demethanizer column bottoms stream composition comprising a recycle content C2 to C4 olefin composition (r-C2 to C4 olefin) formed by the process of any of claims 1-10.

12. The process or composition of any of claims 1-9, wherein said r-LPG is a co
C2 to C4 composition comprises predominantly propylene.

13. The process or composition of any of claims 1-9, wherein said r-C2 to C4
composition comprises predominantly ethylene.

14. The process or composition of any of claims 1-9, wherein the ethylene and
heavier components are present in the bottoms stream in an amount of at least 5 weight
percent and/or not more than 95 weight percent, based on the total weight of the stream.

15. The process or composition of any of claims 1-9, wherein the ethylene and
heavier components are present in the overhead stream in an amount of at least 0.01
weight percent, based on the total weight of the overhead stream.

16. The process or composition of any of claims 1-9, wherein the methane and
lighter components are present in the overhead stream in an amount of at least 5 weight
percent and/or not more than 95 weight percent, based on the total weight of the stream.

17. The process or composition of any of claims 1-9, wherein the methane and
lighter components are present in the bottoms stream in an amount of at least 0.01
weight percent and/or not more than 10 weight percent, based on the total weight of the
stream.

18. The process or composition of any of claims 1-9, wherein the overhead
stream comprises at least 50 percent by weight of the total amount of methane and
lighter components introduced into the column in the feed stream.

19. The process or composition of any of claims 1-9, wherein the overhead
stream comprises at least 70 percent by weight of the total amount of methane and
lighter components introduced into the column in the feed stream.

20. The process or composition of any of claims 1-9, wherein the bottoms stream comprises at least 50 percent by weight of the total amount of ethylene and heavier components introduced into the column in the feed stream.

5 21. The process or composition of any of claims 1-9, wherein the overhead stream comprises not more than 50 percent by weight of the total amount of ethylene and heavier components introduced into the column in the feed stream.

10 22. The process or composition of any of claims 1-9, wherein the bottoms stream comprises not more than 50 percent by weight of the total amount of methane and lighter components introduced into the column in the feed stream.

15 23. The process or composition of any of claims 1-9, wherein r-C2 to C4 olefin composition is present in the feed stream in an amount of at least 5, and/or not more than 99 weight percent, based on the total weight of the feed stream.

20 24. The process or composition of any of claims 1-9, wherein the column feed stream includes methane and lighter components in an amount of at least 1 and/or not more than 50 weight percent, based on the total weight of the feed stream.

25 25. The process or composition of any of claims 1-9, wherein the ratio of the weight of ethylene and heavier components in said overhead stream to the total weight of ethylene and heavier component in said column feed stream is at least 0.1% lower than if said column feed stream did not include said r-C2 to C4 olefin composition but had the same mass flow rate, all other conditions of said demethanizer column being the same.

30 26. The process or composition of any of claims 1-9, wherein the ratio of the weight of ethylene and heavier components in said overhead stream to the total weight of ethylene and heavier component in said column feed stream is at least 0.5% lower than if said cracker feed stream did not include said r-pyoil composition but had the same mass flow rate, all other conditions of said demethanizer column being the same.

27. The process or composition of any of claims 1-9, wherein said demethanizer is operated to lower said ratio of the weight of ethylene and heavier components in said overhead stream to the total weight of ethylene and heavier component in said column feed stream.

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28. The process or composition of any of claims 1-9, wherein the mass flow rate of the column feed stream introduced into said demethanizer column is at least 0.1% higher than if said column feed stream did not include said r-C2 to C4 olefin composition but had the same mass flow rate, all other conditions being the same.

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29. The process or composition of any of claims 1-9, wherein the mass flow rate of the column feed stream introduced into said demethanizer column is at least 0.5% higher than if said furnace feed stream did not include said r-pyoil composition but had the same mass flow rate, all other conditions being the same.

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30. The process or composition of any of claims 1-9, wherein the volumetric or mass flow rate of liquid within said demethanizer column is at least 0.1% higher than if said column feed stream did not include said r-C2 to C4 olefin composition but had the same mass flow rate, all other conditions being the same.

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31. The process or composition of any of claims 1-9, wherein the volumetric or mass flow rate of liquid within said demethanizer column is at least 0.1% higher than if said furnace feed stream did not include said r-pyoil composition but had the same mass flow rate, all other conditions being the same.

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32. The process or composition of any of claims 1-9, wherein the differential pressure across the demethanizer is at least 0.1% lower than if said column feed stream did not include said r-C2 to C4 olefin composition but had the same mass flow rate, all other conditions being the same.

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33. The process or composition of any of claims 1-9, wherein the differential pressure across the demethanizer is at least 0.1% lower than if said furnace feed stream did not include said r-pyoil composition but had the same mass flow rate, all other conditions being the same.

5 34. The process or composition of any of claims 1-9, wherein the ratio of the mass flow rate of furnace feed stream to the mass flow rate of said column feed stream is at least 0.1% higher than if said furnace feed stream did not include said r-pyoil but had the same mass flow rate, all other conditions being the same.

10 35. The process or composition of any of claims 1-9, wherein the mass flow rate of C5 and lighter components in the olefin-containing effluent stream is at least 0.1% higher than if the furnace feed stream did not include said r-pyoil but had the same mass flow rate, all other conditions being the same.

15 36. The process or composition of any of claims 1-9, wherein the mass flow rate of C6 and heavier components in the olefin-containing effluent stream is at least 0.1% higher than if the furnace feed stream did not include said r-pyoil but had the same mass flow rate, all other conditions being the same.

20 37. The process or composition of any of claims 1-9, wherein said furnace feed stream comprises predominantly propane.

 38. The process or composition of any of claims 1-9, wherein said furnace feed stream comprises predominantly ethane.

25 39. The process or composition of any of claims 1-9, wherein said furnace feed stream comprises predominantly C5 to C22 hydrocarbon composition.

 40. The process or composition of any of claims 1-9, wherein the cracking is
30 carried out at an average temperature of at least 700°C and/or not more than 1000°C.

41. The process or composition of any of claims 1-9, wherein the top temperature of said demethanizer column is at least at least -145 °C and/or not more than -120°C.

5 42. The process or composition of any of claims 1-9, wherein the top pressure of said demethanizer column is at least at least 3, or at least 5 in each case barg.

 43. The process or composition of any of claims 1-9, wherein at least 1 weight percent of said r-pyoil is obtained from the pyrolysis of recycled waste.

10 44. The process or composition of any of claims 1-9, wherein not more than 95 weight percent of said r-pyoil is obtained from the pyrolysis of recycled waste.

 45. The process or composition of any of claims 1-9, wherein said recycled waste comprises recycled waste plastic.

 46. The process or composition of any of claims 1-9, wherein said recycled waste comprises waste plastics, waste textiles, waste carpet fibers, waste modified cellulose, waste biomass, post-industrial waste streams, intermediate industrial waste streams, or combinations thereof.

 47. The process or composition of any of claims 1-9, wherein said cracker feedstock has not been hydrotreated.

25 48. The process or composition of any of claims 1-9, wherein said r-pyoil is present in said cracker feedstock in an amount of not more than about 40 weight percent and/or at least about 1 weight percent.

 49. The process or composition of any of claims 1-9, wherein said cracker feedstock composition comprises at least 60 weight percent and/or not more than 100 weight percent of non-recycle C2 to C4 hydrocarbons.

50. The process or composition of any of claims 1-9, wherein said cracker feedstock composition comprises at least 60 weight percent and/or not more than 100 weight percent of non-recycle C5 to C22 hydrocarbons.

5 51. The process or composition of any of claims 1-9, wherein said cracker feedstock composition comprises at least 60 weight percent and/or not more than 100 weight percent of non-recycle propane, ethane, or combinations thereof.

10 52. The process or composition of any of claims 1-9, wherein said cracker feedstock comprises predominantly propane and/or ethane.

53. The process or composition of any of claims 1-9, wherein said cracker feedstock comprises predominantly ethane.

15 54. The process or composition of any of claims 1-9, wherein said olefin-containing effluent comprises predominantly ethylene.

20 55. The process or composition of any of claims 1-9, wherein said olefin-containing effluent comprises at least 30 weight percent olefins, based on the total weight of said olefin-containing effluent.

56. The process or composition of any of claims 1-9, wherein said olefin-containing effluent comprises predominantly propylene.

25 57. The process or composition of any of claims 1-9, wherein said cracker feedstock has a 90% boiling point of not more than 360°C.

30 58. The process or composition of any of claims 1-9, wherein said r-pyoil comprises at least about 1 and/or not more than 30weight percent aromatics, based on the total weight of said r-pyoil.

59. The process or composition of any of claims 1-9, wherein said r-pyoil comprises at least 15 and/or not more than about 90 weight percent of paraffins, based on the total weight of said r-pyoil.

5 60. The process or composition of any of claims 1-9, wherein said cracked effluent stream has an olefins-to-aromatics ratio of at least 1.25:1.