

CLAIMS

What is claimed is:

1. A system for making a pyrolysis oil, said system comprising:
 - 5 (a) a source of at least one recycled plastic waste;
 - (b) a shredding unit configured to at least partially shred said recycled plastic waste into a shredded waste;
 - (c) a separator unit configured to separate said shredded waste into a waste stream and a waste plastic feedstock; and
 - 10 (d) a pyrolysis unit in fluid communication with said separator unit, wherein said pyrolysis unit comprises a first pyrolysis zone and a second pyrolysis zone, wherein said second pyrolysis zone operates at a higher temperature relative to said first pyrolysis zone.
2. The system according to claim 1, wherein said source of at least one recycled plastic waste is in fluid communication with said shredding unit.
3. The system according to claim 1, wherein said source of at least one recycled plastic waste comprises a tank and/or a railroad cart.
4. The system according to claim 1, wherein said source of at least one recycled plastic waste comprises a waste facility.
- 20 5. The system according to any one of claims 1-4, wherein said shredding unit comprises a grinding unit configured to grind at least a portion of said recycled plastic waste.
6. The system according to claim 1, wherein said separator unit comprises a filter, a cyclone separator, a fractionator, a floatation tank, or combinations thereof.
- 25 7. The system according to claim 6, wherein said separator comprises a floatation tank.
8. A pyrolysis feed comprising:
 - (a) at least 25 weight percent of at least one recycled waste; and
 - (b) at least 1 weight percent of at least one industrial byproduct, wherein said industrial byproduct comprises –
 - 30 (i) at least one liquid byproduct produced during the cracking of ethane and/or propane,

- (ii) at least one liquid byproduct during the manufacture of products derived from ethylene and/or propylene,
- (iii) at least one synthetic textile,
- (vi) at least one waste stream derived from the production of synthetic fibers,
- (v) at least one waste stream derived from the production of acetyl,
- (vi) at least one oxygenated hydrocarbon having a carbon chain length of C6-C24,
- (vii) distillers grain,
- (viii) at least one liquid hydrocarbon comprising at least 75 weight percent of C2-C25 aliphatic hydrocarbons and less than 10 weight percent of aromatics,
- (ix) at least one post-industrial waste plastic,
- (x) at least one post-consumer waste oil,
- (xi) at least one post-industrial lubrication oil, or
- (xii) combinations thereof.
9. A method of making pyrolysis oil, said method comprising:
- (a) introducing a pyrolysis feed into a pyrolysis unit, wherein said pyrolysis feed comprises at least 25 weight percent of at least one recycled waste and at least 1 weight percent of at least one industrial byproduct, wherein said industrial byproduct comprises –
- (i) at least one liquid byproduct produced during the cracking of ethane and/or propane,
- (ii) at least one liquid byproduct produced during the manufacture of products derived from ethylene and/or propylene,
- (iii) at least one synthetic textile,
- (iv) at least one waste stream derived from the production of synthetic fibers,
- (v) at least one waste stream derived from the production of acetyl,
- (vi) at least one oxygenated hydrocarbon having a carbon chain length of C6-C24,
- (vii) distillers grain,

(viii) at least one liquid hydrocarbon comprising at least 75 weight percent of C2-C25 aliphatic hydrocarbons and less than 10 weight percent of aromatics,

(ix) at least one post-industrial waste plastic,

5 (x) at least one post-consumer waste oil,

(xi) at least one post-industrial lubrication oil, or

(xii) combinations thereof; and

(b) pyrolyzing at least a portion of said pyrolysis feed in said pyrolysis unit to thereby form a pyrolysis effluent comprising said pyrolysis oil.

10 10. The method according to claim 9, wherein said pyrolysis feed comprises at least 2 weight percent of at least one industrial byproduct.

11. The method according to claim 9, wherein said pyrolysis unit operates at a temperature of 325°C to 800°C.

12. The system or method according to any one of claims 1-7 or 9-11, wherein
15 said pyrolysis unit comprises an extruder.

13. The method according to claim 9, wherein said pyrolyzing occurs at a residence time in the range of 0.1 to 10 seconds.

14. A pyrolysis feed comprising:

(a) at least 25 weight percent of at least one recycled waste; and

20 (b) at least 1 weight percent of at least one crude industrial waste liquid,
wherein said at least one recycled waste and said at least one crude industrial waste liquid are in fluid communication.

15. A pyrolysis feed comprising:

(a) at least 25 weight percent of at least one recycled waste; and

25 (b) at least 1 weight percent of at least one crude industrial waste liquid,

wherein said crude industrial waste liquid comprises –

(i) at least one liquid byproduct produced during the cracking of ethane and/or propane,

30 (ii) at least one liquid byproduct produced during manufacturing of products derived from ethylene and/or propylene,

(iii) at least one waste stream derived from the production of synthetic fibers,

(iv) at least one waste stream derived from the production of acetyl,
(v) at least one liquid hydrocarbon comprising at least 75 weight
percent of C2-C25 aliphatic hydrocarbons and less than 10 weight percent of
aromatics, or

5 (vi) combinations thereof,

wherein said at least one post-consumer waste and said at least one crude
industrial waste liquid are in fluid communication.

16. The pyrolysis feed according to any one of claims 14 or 15, wherein said
crude industrial waste liquid comprises (i) at least one liquid byproduct produced
10 during the cracking of ethane and/or propane, (ii) at least one liquid byproduct
produced during manufacturing of products derived from ethylene and/or propylene,
(iii) at least one waste stream derived from the production of synthetic fibers, (iv) at
least one waste stream derived from the production of acetyl, (v) at least one
oxygenated hydrocarbon having a carbon chain length of C6-C24, (vi) at least one
15 liquid hydrocarbon comprising at least 75 weight percent of C2-C25 aliphatic
hydrocarbons and less than 10 weight percent of aromatics, (vii) at least one post-
consumer waste oil, (viii) at least one post-industrial lubrication oil, or (ix)
combinations thereof.

17. The pyrolysis feed according to claim 15, wherein no single component makes
20 up more than 80 percent of the crude industrial waste liquid based on the total weight
of the crude industrial waste liquid.

18. A method of making pyrolysis oil, said method comprising:

(a) introducing a pyrolysis feed into a pyrolysis unit, wherein said pyrolysis
feed comprises at least 25 weight percent of at least one recycled waste and at least 1
25 weight percent of at least one crude industrial waste liquid, wherein said at least one
post-consumer waste and said at least one crude industrial waste liquid are in fluid
communication; and

(b) pyrolyzing at least a portion of said pyrolysis feed in said pyrolysis unit to
thereby form a pyrolysis effluent comprising said pyrolysis oil.

19. A method of making a pyrolysis oil, said method comprising:

(a) providing a pyrolysis unit;

(b) providing a source of a crude industrial waste liquid in fluid communication with said pyrolysis unit;

(c) pyrolyzing said crude industrial waste liquid in said pyrolysis unit to form a pyrolysis effluent comprising said pyrolysis oil.

- 5 20. The method according to any one of claims 18 or 19, further comprising providing a source of at least one recycled waste.
21. The method according to claims 18 or 19, further comprising pyrolyzing said at least one recycled waste with said at least one crude industrial waste liquid in said pyrolysis unit.
- 10 22. The method according to claim 21, further comprising providing a source of said crude industrial waste liquid.
23. The method according to any one of claims 18 or 19, wherein said source of a crude industrial waste liquid comprises a chemical manufacturing plant.
24. The method according to any one of claims 18 or 19, wherein said source of a crude industrial waste liquid comprises a thermal cracker, a catalytic cracker, a demethanizer, a gasifier, or a quench tower.
- 15 25. The method according to any one of claims 18 or 19, wherein said crude industrial waste liquid comprises (i) at least one liquid byproduct produced during the cracking of ethane and/or propane, (ii) at least one liquid byproduct produced during manufacturing of products derived from ethylene and/or propylene, (iii) at least one waste stream derived from the production of synthetic fibers, (iv) at least one waste stream derived from the production of acetyl, (v) at least one oxygenated hydrocarbon having a carbon chain length of C6-C24, (vi) at least one liquid hydrocarbon comprising at least 75 weight percent of C2-C25 aliphatic hydrocarbons and less than 20 10 weight percent of aromatics, (vii) at least one post-consumer waste oil, (viii) at least one post-industrial lubrication oil, or (ix) combinations thereof.
- 25 26. The pyrolysis feed or method according to any one of claims 18 or 19, wherein no single component makes up more than 80 percent of the crude industrial waste liquid based on the total weight of the crude industrial waste liquid.
- 30 27. The pyrolysis feed or method according to any one of claims 14 or 15, wherein said recycled waste comprises post-consumer waste and/or post-industrial waste.

28. The pyrolysis feed or method according to claim 15, or 18, wherein said post-consumer waste comprises a waste plastic, a waste rubber, a textile, modified cellulose, wet-laid products, or combinations thereof.

29. The pyrolysis feed or method according to claims 15, or 18, wherein said
5 pyrolysis feed comprises at least 30 weight percent of at least one post-consumer wastes.

30. The pyrolysis feed or method according to any one of claims 15 or 19, wherein said pyrolysis feed comprises at least 30 weight percent of at least one post-industrial wastes.

10 31. The pyrolysis feed or method according to any one of claims 15 or 19, wherein said post-consumer waste comprises one or more waste plastics.

32. The pyrolysis feed or method according to any one of claims 8, 9, 14, 15, or 19, wherein said recycled waste comprises at least one recycled waste plastic.

33. The pyrolysis feed or method according to claim 32, wherein said pyrolysis
15 feed comprises at least 30 weight percent of at least one recycled waste plastic.

34. The pyrolysis feed or method according to any one of claims 8-33, wherein said pyrolysis feed comprises at least 2 weight percent of at least one crude industrial waste liquid.

35. The pyrolysis feed or method according to any one of claims 8-33, wherein
20 said pyrolysis feed comprises less than 75 weight percent of at least one crude industrial waste liquid.

36. A system for making a pyrolysis oil, said system comprising:
(a) a pyrolysis unit; and
(b) a source of a crude industrial waste liquid.

25 37. The system according to claim 36, further comprising a source of at least one recycled waste.

38. The system according to claim 37, wherein said source of at least one recycled waste is in fluid communication with said pyrolysis unit and/or said source of a crude industrial waste liquid.

30 39. The system according to claim 36, wherein said source of a crude industrial waste liquid comprises a chemical manufacturing plant.

40. The system according to claim 37, wherein said source of a crude industrial waste liquid comprises a thermal cracker, a catalytic cracker, a demethanizer, a gasifier, or a quench tower.

41. The system according to any one of claim 37, wherein said source of at least one recycled waste comprises a recycled plastic source.

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