

CLAIMS

What is claimed is:

- 5 1. A method for processing waste plastic, said method comprising:
introducing at least a portion of a light organics coproduct stream from
a solvolysis facility into at least one of the following downstream
chemical processing facilities: (i) a partial oxidation (POX) gasification
facility; (ii) a pyrolysis facility; (iii) an energy recovery facility; or a (iv) a
cracker facility.
- 10 2. The method of claim 1, further comprising prior to said introducing
combining at least a portion of said light organics coproduct stream
with another stream to form a combined stream and introducing said
combined stream into at least one of said downstream chemical
processing facilities (i) through (iv).
- 15 3. The method of claim 2, wherein said another stream comprises
another solvolysis coproduct stream withdrawn from said solvolysis
facility.
- 20 4. The method of claim 2, wherein said another stream comprises waste
plastic.
- 25 5. The method of claim 2, wherein said another stream comprises
polyolefin (PO) in an amount in the range of from 10 to 95 weight
percent, based on the total weight of the stream.
6. The method of claim 2, wherein said another stream comprises
liquified plastic.
- 30 7. The method of claim 2, wherein said another stream comprises
pyrolysis oil.

- 5 8. The method of any of claims 1-7, further comprising introducing at least a portion of said light organics coproduct stream into said POX gasification facility, wherein said POX gasification facility includes a solid gasifier.
- 10 9. The method of any of claims 1-7, further comprising prior to at least a portion of said introducing, subjecting a feed stream comprising waste plastic to solvolysis in said solvolysis facility to produce a principal glycol product stream, a principal terephthalyl product stream, and said light organics coproduct stream.
- 15 10. The method of claim 9, wherein said light organics coproduct stream has an average boiling point lower than the boiling point of said principal glycol.
- 20 11. The method of claim 9, wherein said feed stream further comprises textiles in an amount in the range of from 0.1 to 25 weight percent, based on the total weight of the feed stream.
- 25 12. The method of claim 9, wherein said feed stream further comprises carpet in an amount in the range of from 0.1 to 25 weight percent, based on the total weight of the feed stream.
- 30 13. The method of claim 9, wherein said light organics coproduct stream comprises said principal solvent, at least one acetaldehyde, para-dioxane (p-dioxane), and at least one additional component selected from at least one additional component selected from the group consisting of tetrahydrofuran (THF), methyl acetate, silanes, 2,5-methyl dioxolane, 1,4-cyclohexanedimethanol, 2-ethyl-1-hexanol, 2,2,4,4,- tetramethyl-1,3-cyclobutanediol, 2,2,4-trimethyl-3-pentenal, 2,2,4-

- 5 trimethyl-3-pentenol, 2,2,4-trimethylpentane, 2,4-dimethyl-3-pentanone (DIPK), isobutyl isobutyrate, methyl formate, n-butanol, acetic acid, dibutyl ether, heptane, dibutyl terephthalate, dimethyl phthalate, dimethyl 1,4-cyclohexanedicarboxylate, 2-methoxyethanol, 2-methyl-1,3-dioxolane, 1,1-dimethoxy-2-butene, 1,1-dimethoxyethane, 1,3-propanediol, 2,5-dimethyl-1,3,5-hexadiene, 2,5-dimethyl-2,4-hexadiene, alpha-methyl styrene, diethylene glycol methyl ether, diethylene glycol formal, dimethoxydimethyl silane, dimethyl ether, diisopropyl ketone, EG benzoate, hexamethylcyclotrisiloxane, 10 hexamethyldisiloxane, methoxytrimethylsilane, methyl 4-ethylbenzoate, methyl caproate, methyl glycolate, methyl lactate, methyl laurate, methyl methoxyethyl terephthalic acid, methyl nonanoate, methyl oleate, methyl palmitate, methyl stearate, octamethylcyclotetrasiloxane, styrene, trimethylsilanol, 1,1-dimethoxy-15 2-butene, 4-methyl morpholine, 1,3,3-trimethoxypropane, methyl myristate, dimethyl adipate, n-methyl-caprolactam, dimethyl azelate, neopentyl glycol, and combinations thereof.
14. The method of claim 9, wherein said light organics stream comprises
20 at least one azeotrope with water, with said principal glycol, and/or with said principal solvent.
15. The method of any of claims 1-7, further comprising introducing a
25 second solvolysis coproduct stream from said solvolysis facility into at least one of said POX gasification facility, said pyrolysis facility, said energy recovery facility, and said cracker facility.
16. The method of claim 15, wherein said light organics coproduct stream
30 and said second solvolysis coproduct stream are introduced into different ones of said POX gasification facility, said pyrolysis facility, said energy recovery facility, and said cracker facility.

- 5 17. The method of claim 15, further comprising introducing said second solvolysis coproduct stream from said solvolysis facility into a polymer melt tank along with a stream of waste plastic to form a melt tank vapor stream and a melted plastic stream and introducing at least a portion of at least one of said melt tank vapor stream and said melted plastic stream into one or more of said downstream chemical processing facilities.
- 10 18. The method of any of claims 1-7, further comprising introducing at least a portion of said light organics coproduct stream into at least two of the following downstream chemical processing facilities: (i) a partial oxidation (POX) gasification facility; (ii) a pyrolysis facility; (iii) an energy recovery facility; or a (iv) a cracker facility.
- 15 19. The method of any of claims 1-7, wherein the solvolysis facility is a methanolysis facility.
- 20 20. A method for processing waste plastic, said method comprising:
(a) combining at least one solvolysis coproduct stream withdrawn from a solvolysis facility with a stream of waste plastic in a liquification tank;
(b) withdrawing at least a vapor stream and a liquified stream from said liquification tank; and
(c) introducing at least a portion of said vapor stream and/or at least a portion of said liquified stream into at least one of the following: (i) a partial
25 oxidation (POX) gasification facility; (ii) a pyrolysis facility; (iii) an energy recovery facility; or a (iv) a cracker facility.
- 30 21. The method of claim 20, wherein said stream of waste plastic includes at least 50 weight percent of polyolefin (PO), based on the total weight of the stream.

- 5 22. The method of claim 20 or 21, further comprising prior to introducing of step (c), passing at least a portion of said vapor stream through a scrubber to remove at least a portion of one or more components and introducing the scrubbed vapor stream withdrawn from the scrubber into one or more of the downstream chemical processing facilities.
- 10 23. The method of any of claims 20 or 21, wherein step (c) comprises introducing at least a portion of said vapor stream into at least one of said partial oxidation (POX) gasification facility, said energy recovery facility, and said cracker facility and introducing at least a portion of said liquified stream into at least one of said POX gasification facility, said pyrolysis facility, and said energy recovery facility.
- 15 24. A method for processing waste plastic, said method comprising:
(a) combining at least one recycle content solvent stream with a waste plastic stream to form a combined stream;
(b) separating said combined stream to provide at least a vapor stream and a liquified stream; and
(c) introducing at least a portion of said vapor stream and/or at least a portion of said liquified stream into at least one of the following: (i) a partial
20 oxidation (POX) gasification facility; (ii) a pyrolysis facility; (iii) an energy recovery facility; or a (v) a cracker facility.
- 25 25. The method of claim 24, wherein at least a portion of said combining is carried out in a liquification tank.
26. The method of claim 24 or 25, wherein said recycle content solvent stream comprises at least 1 weight percent recycle content, based on the total weight of the stream.
- 30 27. The method of any of claims 24 or 25, wherein said recycle content solvent stream comprises a solvolysis coproduct stream.

28. The method of any of claims 24 or 25, wherein said recycle content solvent stream comprises a pyrolysis oil stream.
- 5 29. The method of any of claims 24 or 25, wherein said waste plastic stream comprises at least 50 weight percent polyolefin, based on the total weight of the stream.
30. A light organic solvolysis coproduct composition formed within a solvolysis facility for processing polyester terephthalate-containing waste plastic to form a principal glycol product and a principal terephthalyl product using a solvent, said composition comprising:
 10 said principal solvent;
 acetaldehyde;
 para-dioxane (p-dioxane); and
 15 at least one additional component selected from the group consisting of silanes, 2,5-methyl dioxolane, 2-ethyl-1-hexanol, 2,2,4,4,-tetramethyl-1,3-cyclobutanediol, 2,2,4-trimethyl-3-pentenal, 2,2,4-trimethyl-3-pentenol, 2,2,4-trimethylpentane, 2,4-dimethyl-3-pentanone (DIPK), isobutyl isobutyrate, methyl formate, n-butanol, dibutyl ether,
 20 heptane, dibutyl terephthalate, dimethyl 1,4-cyclohexanedicarboxylate, 1,1-dimethoxy-2-butene, 1,3-propanediol, 2,5-dimethyl-1,3,5-hexadiene, 2,5-dimethyl-2,4-hexadiene, alpha-methyl styrene, diethylene glycol formal, dimethoxydimethyl silane, dimethyl ether, diisopropyl ketone, hexamethylcyclotrisiloxane, hexamethyldisiloxane,
 25 methoxytrimethylsilane, methyl 4-ethylbenzoate, methyl caproate, methyl lactate, methyl laurate, methyl methoxyethyl terephthalic acid, methyl nonanoate, methyl oleate, methyl palmitate, methyl stearate, octamethylcyclotetrasiloxane, styrene, trimethylsilanol, 1,1-dimethoxy-2-butene, 4-methyl morpholine, 1,3,3-trimethoxypropane, methyl
 30 myristate, dimethyl adipate, n-methyl-caprolactam, dimethyl azelate, neopentyl glycol, and combinations thereof.

31. The composition of claim 30, wherein said at least one additional component is selected from the group consisting of 2,2,4,4,-tetramethyl-1,3-cyclobutanediol, 2,2,4-trimethyl-3-pentenal, 2,2,4-
5 trimethyl-3-pentenol, 2,2,4-trimethylpentane, 2,4-dimethyl-3-pentanone (DIPK), isobutyl isobutyrate, dimethoxydimethyl silane, methoxytrimethylsilane, methyl nonanoate, methyl oleate, methyl stearate, and combinations thereof.
32. The composition of claim 30, wherein said at least one additional
10 component is selected from the group consisting of 1,1-dimethoxy-2-butene, 4-methyl morpholine, 1,3,3-trimethoxypropane, methyl myristate, dimethyl adipate, n-methyl-caprolactam, dimethyl azelate, neopentyl glycol, and combinations thereof.
33. The composition any of claims 30-32, wherein said solvent is present
15 in said light organics coproduct stream in an amount in the range of from 2 to 90 weight percent, based on the total weight of the stream.
34. The composition any of claims 30-32, further comprising at least one
20 azeotrope with water, said principal solvent, and/or said principal glycol.
35. The composition any of claims 30-32, wherein said light organics
25 coproduct stream further comprises water in an amount of at least 2 weight percent, wherein said principal glycol is present in an amount of at least 2 weight percent, wherein said p-dioxane is present in an amount of 1 ppm to 50 weight percent, wherein said acetaldehyde is present in an amount of 1 ppm to 50 weight percent, all percentages based on the total weight of the stream, wherein said solvent
30 comprises methanol, said glycol comprises ethylene glycol, and said terephthalyl comprises dimethyl terephthalate.