CLAIMS

What is claimed is:

1. A continuous process for converting waste plastic into recycle for polyethylene polymerization comprising:

(a) selecting waste plastics containing polyethylene and/or polypropylene;

(b) passing the waste plastics from (a) through a pyrolysis reactor to thermally crack at least a portion of the polyolefin waste and produce a pyrolyzed effluent;

(c) separating the pyrolyzed effluent into offgas, a pyrolysis oil comprising naphtha, diesel and heavy fractions, and char;

(d) passing the pyrolysis oil from (c) to a filtration unit followed by a metal oxide treatment;

(e) recovering the treated pyrolysis oil from the metal oxide treatment and passing same to a refinery FCC unit;

(f) recovering a liquid petroleum C_3 olefin/paraffin mixture fraction from the FCC unit; and

(g) passing the liquid petroleum gas C_3 olefin/paraffin mixture fraction to a steam cracker for ethylene production.

2. The process of claim 1, wherein a gasoline and heavy fraction are recovered from the refinery FCC unit.

3. The process of claim 1, wherein ethylene produced in (g) is subsequently polymerized.

4. The process of claim 3, wherein polyethylene products are prepared from the polymerized ethylene.

5. The process of claim 2, wherein the amount of gasoline produced by the FCC unit is increased due to the treated pyrolysis oil passed to the FCC unit in (e).

6. The process of claim 1, wherein the filtration employs a filter having pores averaging 5 microns or less in diameter.

7. The process of claim 6, wherein the pores average less than 1 micron in diameter.

8. The process of claim 1, wherein the metal oxide treatment comprises a metal oxide selected from CaO, ZnO, MgO, NiO, MoO_3, alumina, silica,silica-alumina, or clay or a mixture thereof.

9. The process of claim 1, wherein the metal oxide treatment occurs at a temperature above 200° F (93° C).

10. The process of claim 1, wherein the waste plastics selected in (a) are from plastics classification group 2, 4, and/or 5.

11. The process of claim 1, wherein the filtration/metal oxide treatment occurs in a refinery comprising the FCC unit.

12. The process of claim 1, wherein filtration occurs at a pyrolysis facility and the metal oxide treatment occurs at a refinery comprising the FCC unit.

13. The process of claim 1, wherein the content of heptane insolubles is reduced to less than 0.1 wt% after the filtration treatment.

14. The process of claim 1, wherein the chloride content is reduced to less 5 ppm after the metal oxide treatment.

15. The process of claim 1, wherein the total metal impurity content is less than 10 ppm after the metal oxide treatment.

16. The process of claim 1, wherein solid particulate and chloride reduction is achieved in the filtration/metal oxide treatment of (d), and S, diene, olefin, and N reduction is achieved by the refinery FCC unit.

17. The process of claim 1, wherein only the diesel and heavy fractions of the pyrolysis oil, or the heavy fraction of the pyrolysis oil, is passed to the filtration and metal oxide treatment.

18. The process of claim 1, wherein the treated pyrolysis oil recovered in (e) is first passed to an FCC pretreatment unit, from which effluent is recovered, and which recovered effluent is passed to the refinery FCC unit.

19. The process of claim 18, wherein solid particulates and chloride reduction is achieved in the filtration/metal oxide treatment of (d), and S, diene, olefin and N reduction is achieved in the FCC feed pretreatment unit.

20. A continuous process for converting waste plastic into recycle for polyethylene polymerization comprising:

(a) selecting waste plastics containing polyethylene and/or polypropylene;

(b) passing the waste plastics from (a) through a pyrolysis reactor to thermally crack at least a portion of the polyolefin waste and produce a pyrolyzed effluent;

(c) separating the pyrolyzed effluent into offgas, a pyrolysis oil comprising naphtha, diesel and heavy fractions, and char;

(d) passing the pyrolysis oil from (c) to a filtration unit followed by a metal oxide treatment; and

(e) recovering the treated pyrolysis oil from the metal oxide treatement and forwarding same to a refinery.

21. The process of claim 20, wherein the filtration employs a filter having pores averaging 5 microns or less in diameter.

22. The process of claim 21, wherein the pores average less than 1 micron in diameter.

23. The process of claim 20, wherein the metal oxide treatment comprises a metal oxide selected from CaO, ZnO, MgO, alumina, silica or silica-alumina, or a mixture thereof.

24. The process of claim 20, wherein the metal oxide treatment occurs at a temperature above 200° F (93° C).

25. The process of claim 20, wherein the content of heptane insolubles is reduced to less than 0.1 wt% after the filtration treatment.

26. The process of claim 20, wherein the chloride content is reduced to less 5 ppm after the metal oxide treatment.

27. The process of claim 20, wherein the total metal impurity content is less than 10 ppm after the metal oxide treatment.

28. The process of claim 20, wherein filtration occurs at a pyrolysis facility and the metal oxide treatment occurs at a refinery comprising the FCC unit

29. The process of claim 20, wherein the waste plastics selected in (a) are from plastics classification group 2, 4, and/or 5.

30. The process of claim 20 further comprising producing sustainable fuel product in the refinery and blending the products to produce gasoline, jet and/or diesel products.

31. The process of claim 30, wherein a jet fuel product is produced.