CLAIMS

1. A process for converting waste plastics, comprising:
   feeding a waste plastic to a melt tank;
   in the melt tank, heating the waste plastic to form a heated molten plastic;
   withdrawing the heated molten plastic from the melt tank and feeding the heated molten plastic to a pyrolysis reactor;
   in the pyrolysis reactor, heating the heated molten plastic to a pyrolysis temperature, producing a pyrolysis oil product and a liquid pitch product; and
   separating the pyrolysis oil product into a pyrolysis gas fraction, a light pyrolysis oil fraction, a medium pyrolysis oil fraction, and a heavy pyrolysis oil fraction;
   dividing the medium pyrolysis oil fraction into a first medium portion and a second medium portion;
   dividing the heavy pyrolysis oil fraction into a first heavy portion and a second heavy portion;
   quenching the pyrolysis oil recovered from the pyrolysis reactor with the second medium portion; and
   feeding the second heavy portion to the melt tank.
2. The process of claim 1, wherein the waste plastic is provided to the melt tank as a partially or fully melted waste plastic recovered from an extruder, the process further comprising partially or fully melting the waste plastic in the extruder.
3. The process of claim 1, further comprising controlling a temperature in the pyrolysis reactor to limit a temperature of the heated molten plastic to a temperature below that at which char or coke will form.
4. The process of claim 1, further comprising:
   dividing the heated molten plastic into a first portion and a second portion;
   mixing the second portion with the waste plastic upstream of the melt tank; and
   feeding the first portion to the pyrolysis reactor.
5. The process of claim 1, further comprising, prior to feeding the waste plastic to the melt tank, contacting the waste plastic with nitrogen at a temperature sufficient to remove water from the waste plastic.
6. The process of claim 1, further comprising:

further dividing the medium pyrolysis oil fraction into a third medium portion; and

mixing the third medium portion with the heated molten plastic, wherein the mixing is performed downstream of the melt tank and upstream of the pyrolysis reactor.

7. The process of claim 1, further comprising providing heat to one or both of the melt tank or the pyrolysis reactor directly or indirectly via combustion of the pyrolysis gas fraction.
8. The process of claim 1, further comprising mixing an alkaline reagent with the heated molten plastic, downstream of the melt tank and upstream of the pyrolysis reactor, reacting the alkaline reagent with chlorine contained in the heated molten plastic to form calcium salts, and recovering the calcium salts with the liquid pitch product.
9. The process of claim 1, further comprising withdrawing a vapor stream from the melt tank, and optionally treating the vapor stream to remove any halogens contained therein.
10. A system for pyrolyzing a waste plastic, the system comprising:

a melt tank having:

an inlet configured for receiving a feed stream comprising waste plastic from a waste plastic feed system;

a heating system configured for heating the waste plastic from a feed temperature to a melt temperature, producing a molten plastic;

an outlet configured for outputting the molten plastic;

a pyrolysis reactor having:

an inlet configured to receive the molten plastic;

a heating system configured to heat the molten plastic to a pyrolysis temperature;

a first outlet for recovering a pyrolysis oil;

a second outlet for recovering a pitch product; and

a control system configured to control the heating system to limit a temperature of the molten plastic to a temperature for production of the pitch product;

a separation system configured to separate the pyrolysis oil product into a pyrolysis gas fraction, a light pyrolysis oil fraction, a medium pyrolysis oil fraction, and a heavy pyrolysis oil fraction; and

a flow line and mixing system configured for feeding and mixing a portion of the heavy pyrolysis oil fraction with the heated molten plastic, wherein the mixing system is

disposed inside the melt tank or downstream of the melt tank outlet and upstream of the pyrolysis reactor inlet; and

a quench system configured to quench the pyrolysis oil recovered via the first outlet with a portion of the medium pyrolysis oil fraction.

11. The system of claim 10, wherein the waste plastic feed system comprises an extruder for partially or fully melting the waste plastic.
12. The system of claim 10, further comprising:

a flow line, disposed intermediate the melt tank outlet and the pyrolysis reactor inlet configured to divide the molten plastic into a first portion, fed to the pyrolysis reactor inlet, and a second portion; and

a mixing system configured to mix the second portion of the molten plastic with the waste plastic upstream of the inlet and downstream of the waste plastic feed system.

13. The system of claim 10, wherein the waste plastic feed system comprises a feed hopper and a screw conveyor, the system further comprising:

a nitrogen supply and a nitrogen feed line for providing nitrogen to at least one of the feed hopper and the screw conveyor; and

a nitrogen heater configured for heating the nitrogen to a temperature greater than 100°C.

14. The system of claim 10, further comprising a flow line configured for feeding the pyrolysis gas fraction as a fuel to a heater.
15. The system of claim 14, wherein the heater is configured to provide a heated thermal exchange fluid to the melt tank heating system, a heat exchanger disposed downstream of the melt tank outlet and upstream of the pyrolysis reactor inlet, and a nitrogen heater.
16. The system of claim 10, wherein the melt tank heating system comprises an external jacket disposed around an internal melt tank vessel and one or more heating coils disposed within the internal melt tank vessel.