Claims

1. A solution polymerization process for producing ethylene-based polymer comprising:

introducing ethylene monomer, hydrocarbon solvent, and Ziegler-Natta catalyst into a solution polymerization reactor;

producing the ethylene-based polymer by solution polymerizing the ethylene monomer and the hydrocarbon solvent in the solution polymerization reactor using the Ziegler-Natta catalyst;

introducing catalyst deactivator to the solution polymerization reactor, thereby producing hydrochloric acid byproduct,

wherein the catalyst deactivator comprises:

long chain carboxylate and at least one cation selected from Groups 1, 2, and 12 of the IUPAC periodic table, with an exception of calcium, ~~and~~

wherein the catalyst deactivator reduces effectiveness of the Ziegler-Natta catalyst and neutralizes the hydrochloric acid by forming a chloride salt other than calcium chloride,

wherein the catalyst deactivator is added to the solution polymerization reactor in an amount from greater than or equal to 0.2 molar equivalents to less than 8.0 molar equivalents with respect to the hydrolysable chlorides, and

wherein the catalyst deactivator is added to the exit of the solution polymerization reactor when a temperature within the solution polymerization reactor is from greater than or equal to 160 °C to less than or equal to 220 °C.

2. The method of claim 1, wherein additional olefin comonomer is introduced into the solution polymerization reactor with at least one of the ethylene monomer, hydrocarbon solvent, and Ziegler-Natta catalyst.

3. The method of claim 2, wherein the additional olefin comonomer is selected from the group consisting of propene, butene, pentene, hexene, pentene, octene, nonene, decene, undecene, dodecene, and combinations thereof.

4. The method according to any one of claims 1 to 3, wherein the hydrocarbon solvent is selected from the group consisting of C_6 to C_{12} olefins, C_6 to C_{12} paraffins, and mixtures thereof.

5. The method of any one of claims 1 to 4, wherein co-catalyst is introduced into the solution polymerization reactor with at least one of the ethylene monomer, hydrocarbon solvent, and Ziegler-Natta catalyst.

6. The method of any one of claims 1 to 5, wherein the Ziegler-Natta catalyst is selected from the group consisting of a $MgCl_2$-supported transition metal catalyst where the transition metal can be selected from Ti, Zr, V, and Hf.

7. The method of any one of claims 1 to 6, wherein the catalyst deactivator is introduced into the solution polymerization reactor near an exit of the solution polymerization reactor.

8. The method of any one of claims 1 to 7, wherein the at least one cation is selected from Groups 1, 2, and 12 of the IUPAC periodic table, with an exception of calcium.

9. The method of any one of claims 1 to 8, wherein the long chain carboxylate comprises from greater than or equal to 6 carbon atoms to less than or equal to 40 carbon atoms.

10. The method of any one of claims 1 to 9, wherein the long chain carboxylate comprises from greater than or equal to 12 carbon atoms to less than or equal to 22 carbon atoms.

11. The method according to any one of claims 1 to 10, wherein the catalyst deactivator has a formula: $M[RCOO]_x$, where M is selected from sodium, zinc, and magnesium, R is selected from stearyl ($C_{17}H_{35}$) and oleyl ($C_{17}H_{33}$), and x is 1 or 2.

~~12. The method of any one of claims 1 to 13, wherein the catalyst deactivator is added to the solution polymerization reactor in an amount from greater than or equal to 0.2 molar equivalents to less than 8.0 molar equivalents with respect to the hydrolyzable chlorides.~~

~~13. The method of any one of claims 1 to 14, wherein the catalyst deactivator is added to the exit of the solution polymerization reactor when a temperature within the solution polymerization reactor is from greater than or equal to 160°C to less than or equal to 220°C.~~