form of a solution in an aromatic solvent such as toluene. The use of even a small quantity of such an aromatic solvent for this purpose is undesirable since it must be removed in a devolatilization step and separated from other volatile components, a process that adds significant cost and complexity to any commercial process. In addition, the foregoing ionic cocatalysts often exist in the form of an oily, intractable material which is not readily handled and metered or precisely incorporated into the reaction mixture.

Highly soluble ammonium tetrakis(pentafluorophenyl)borate catalyst activator has been developed and successfully used in polyolefin production. Such activator is described in PCT Publication No. WO1997035893. Such highly soluble catalyst activator comprised a bis(hydrogenated tallowalkyl)methylamine derived from beef tallow. Due to increasing concerns over animal-derived material, and possible spread of Transmissible Spongiform Encephalopathies, there is a need to develop a highly soluble borate activator produced exclusively from non-animal-derived material. However, non-animal-derived high molecular weight tertiary amines that can be used as a direct replacement for the tertiary amine derived from beef tallow, currently, is not commercially available. Therefore, a method of making a tertiary amine for use in producing highly soluble catalyst activator, wherein the process does not utilize animal-derived products, is desirable.

Summary ~~of the Invention~~

The instant ~~invention~~ disclosure is a method of making a catalyst activator, a catalyst composition containing the activator, and a polymerization method utilizing such catalyst composition.

In one embodiment, the instant ~~invention~~ disclosure provides for preparing ammonium tetrakis(pentafluorophenyl)borate salt comprising: reacting a secondary amine with an aldehyde to form an iminium ion; hydrogenating the iminium ion by reaction with a reducing agent to form a tertiary amine; reacting the tertiary amine with HCl to form a amine chlorine salt; and reacting the amine chlorine salt with $K[B(C_6F_5)_4]$ to form an ammonium tetrakis(pentafluorophenyl)borate salt, wherein the secondary amine is derived from a non-animal source and the aldehyde has seven or more carbon atoms; wherein the ammonium tetrakis(pentafluorophenyl)borate salt is characterized by a solubility at 25 °C in hexane, cyclohexane or methylcyclohexane of at least 20 weight percent; and wherein the tertiary amine has a molecular weight of at least 450 g/mole.

In one aspect, there is provided a method for preparing ammonium tetrakis(pentafluorophenyl)borate salt comprising:

reacting a secondary amine with an aldehyde to form an iminium ion;

hydrogenating the iminium ion by reaction with a reducing agent to form a tertiary amine;

reacting the tertiary amine with one or more mineral acids to form an amine chloride salt; and

reacting the amine chloride salt with $K[B(C_6F_5)_4]$, $Li[B(C_6F_5)_4]$, or a combination thereof, to form an ammonium tetrakis(pentafluorophenyl)borate salt,

wherein the secondary amine is derived from a non-animal source and the aldehyde has seven or more carbon atoms;

wherein the ammonium tetrakis(pentafluorophenyl)borate salt is characterized by a solubility at 25 °C. in hexane, cyclohexane or methylcyclohexane of at least 10 weight percent; and

wherein the tertiary amine has a molecular weight of at least 450 g/mole.

CLAIMS:

1. A method for preparing ammonium tetrakis(pentafluorophenyl)borate salt comprising:

reacting a secondary amine with an aldehyde to form an iminium ion;

hydrogenating the iminium ion by reaction with a reducing agent to form a tertiary amine;

reacting the tertiary amine with one or more mineral acids to form an amine chloride salt; and

reacting the amine ~~mineral~~ chloride salt with $K[B(C_6F_5)_4]$, $Li[B(C_6F_5)_4]$, or a combination thereof, to form an ammonium tetrakis(pentafluorophenyl)borate salt,

wherein the secondary amine is derived from a non-animal source and the aldehyde has seven or more carbon atoms;

wherein the ammonium tetrakis(pentafluorophenyl)borate salt is characterized by a solubility at 25 °C. in hexane, cyclohexane or methylcyclohexane of at least 10 weight percent; and

wherein the tertiary amine has a molecular weight of at least 450 g/mole.

2. The method according to claim 1, wherein the reacting a secondary amine with an aldehyde occurs under conditions to drive the reaction to completion.

3. The method according to claim 2, wherein the reacting a secondary amine with an aldehyde occurs in the presence of a dehydrating agent selected from the group consisting of $MgSO_4$,Na_2SO_4, $CaCl_2$, molecular sieves, activated alumina, silica gel, and combinations thereof.

4. The method according to claim 1, wherein the reducing agent is selected from the group consisting of sodium triacetoxyborohydride. $NaBH_4$, $NaBH_3CN$, $Zn(BH_4)_2$, $((C_6H_5)_3P)_2Cu(BH_4)$, NR_4BH_4, BH_3, and combinations thereof.

5. The method according to claim 1, wherein the reducing agent is sodium triacetoxyborohydride.

6. The method according to claim 1, wherein the aldehyde is $C_7H_{14}O$.

7. The method according to claim 1, wherein the aldehyde is $C_{12}H_{24}O$.

~~8. The method according to claim 6, wherein the ammonium tetrakis(pentafluorophenyl)borate salt is produced at a level of at least 80% based on the weight of potassium tetrakis(pentafluorophenyl)borate.~~

~~9. The method according to claim 7, wherein the ammonium tetrakis(pentafluorophenyl)borate salt is produced at a level of at least 80% based on the weight of potassium tetrakis(pentafluorophenyl)borate.~~

~~10. The method according to claim 6, wherein the ammonium tetrakis(pentafluorophenyl)borate salt is soluble in methylcyclohexane at levels greater than 25 wt%.~~