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(71) Applicant: CHEVRON U.S.A. INC. [US/US]; 6001 Bollinger Canyon Road, San Ramon, California 94583 (US).

(72) Inventor: LACHEEN, Howard Steven; 6001 Bollinger Canyon Road, San Ramon, California 94583 (US).

(74) Agents: ABERNATHY, Susan M. et al.; Chevron Services Company, Post Office Box 6006, San Ramon, California 94583-0806 (US).

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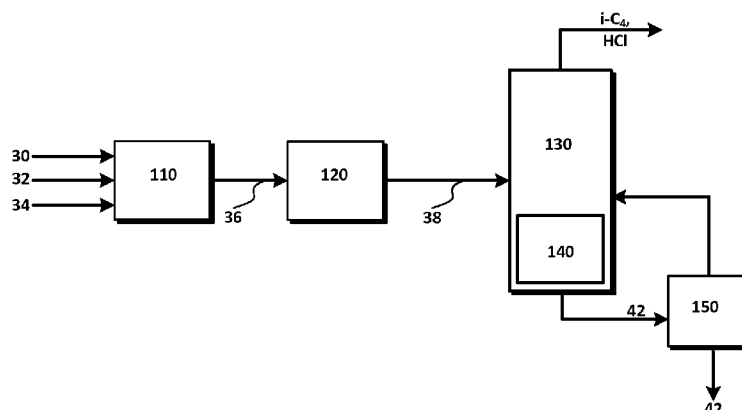


FIG. 1A

(57) Abstract: Processes for decomposing organic chloride in a hydrocarbon stream may comprise contacting a hydrocarbon stream with a dechlorination element in a dechlorination zone under dechlorination conditions to provide a dechlorinated hydrocarbon product, wherein the dechlorination element may comprise a metal or metal alloy having a high surface area configuration. Such a dechlorination element may be disposed within one or more distillation columns and/or within a separate dechlorination vessel.

DECOMPOSITION OF ORGANIC CHLORIDE IN ALKYLATE USING METALS AND ALLOYS

TECHNICAL FIELD

5 This disclosure relates to the decomposition of organic chlorides in alkylate using metals and metal alloys.

BACKGROUND

There is a need for processes for the efficient removal of organic chloride from alkylate products, such as alkylate gasoline obtained by ionic liquid catalyzed alkylation.

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SUMMARY

In an embodiment there is provided a dechlorination process comprising providing a hydrocarbon stream comprising an alkylate product in combination with an organic chloride contaminant, and contacting the hydrocarbon stream under dechlorination conditions in a dechlorination zone with a dechlorination element having a surface area per unit volume in the range from 250 to 1000 m².m⁻³ to decompose the organic chloride and to provide a dechlorinated alkylate product, wherein the dechlorination element has a metal surface comprising a metal alloy.

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20 In another embodiment, there is provided a dechlorination process comprising providing a hydrocarbon stream comprising an alkylate product in combination with an alkyl chloride contaminant, and contacting the hydrocarbon stream under dechlorination conditions in a dechlorination zone, in the substantial absence of H₂ gas, with a dechlorination element comprising from 90 to 100 wt% of a metal alloy to decompose the alkyl chloride and to provide a dechlorinated alkylate product, wherein the dechlorination element has a metal surface of uniform composition comprising the metal alloy, the dechlorination element has a surface area per unit volume in the range from 250 to 1000 m².m⁻³, and the metal alloy comprises from 95 to 100 wt% of an elemental metal selected from the group consisting of Al, Co, Cr, Cu, Fe, Mg, Mn, Mo, Nb, Ni, Pb, Ta, Ti, V, W, Zr, and combinations thereof.

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In a further embodiment, there is provided a dechlorination process comprising contacting an isoparaffin and an olefin with an ionic liquid catalyst in an ionic liquid alkylation zone under ionic liquid alkylation conditions; separating a hydrocarbon stream from an effluent of the

ionic liquid alkylation zone, wherein the hydrocarbon stream comprises an alkylate product in combination with an alkyl chloride contaminant; feeding the hydrocarbon stream to a distillation column having a dechlorination element disposed therein; and contacting the hydrocarbon stream with the dechlorination element under dechlorination conditions in a dechlorination zone within the distillation column to decompose the alkyl chloride so as to generate HCl and to provide a dechlorinated alkylate product. The dechlorination element has a metal surface of uniform composition comprising from 95 to 100 wt% of an elemental metal selected from the group consisting of Al, Co, Cr, Cu, Fe, Mg, Mn, Mo, Nb, Ni, Pb, Ta, Ti, V, W, Zr, and combinations thereof; and the dechlorination element has a surface area per unit volume in the range from 250 to 1000 m².m⁻³.

As used herein, the terms “comprising” and “comprises” mean the inclusion of named elements or steps that are identified following those terms, but not necessarily excluding other unnamed elements or steps.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1A schematically represents a process and system for the decomposition of organic chloride present in a hydrocarbon stream, according to an embodiment of the present invention;

Figure 1B schematically represents a process and system for the decomposition of organic chloride present in a hydrocarbon stream, according to another embodiment of the present invention;

Figure 1C schematically represents a process and system for the decomposition of organic chloride present in a hydrocarbon stream, according to a further embodiment of the present invention; and

Figure 2 shows a reduction in the chloride concentration of alkylate after contacting the alkylate with carbon steel under dechlorination conditions, according to another embodiment of the present invention.

DETAILED DESCRIPTION

Ionic liquid catalysts may be useful for a range of hydrocarbon conversion reactions, including alkylation reactions for the production of alkylate, e.g., comprising gasoline blending components, and the like. In an embodiment, processes disclosed herein provide for the removal of organic chloride from alkylate, wherein the alkylate may be obtained by ionic liquid catalyzed alkylation and may contain undesirably high levels of organic chloride.

Processes for decomposing organic chloride in hydrocarbon streams as disclosed and described herein may involve contacting a hydrocarbon stream with a dechlorination element in a dechlorination zone under dechlorination conditions to provide a dechlorinated hydrocarbon product. In an embodiment, the dechlorination element may comprise a solid metal or various metal alloys, and the dechlorination element may have a pre-defined configuration with a high surface area per unit volume.

In an embodiment, the dechlorination element may be integral with one or more distillation columns, and the hydrocarbon stream may comprise a feed to the distillation column(s). As a non-limiting example, the dechlorination element may be disposed within a lower portion of a distillation column, such as an isostripper and/or a debutanizer. In another embodiment, the dechlorination element may be housed within a separate dechlorination vessel disposed external to a distillation column, the dechlorination vessel/dechlorination element may be in fluid communication with the distillation column, and the hydrocarbon stream may comprise a fraction from the distillation column. The external dechlorination vessel may be disposed either upstream or downstream from a reboiler of the distillation column.

The term “alkylate” may be used herein to refer to a hydrocarbon containing fraction, stream, or product from an alkylation reaction. Applicants have found that organic chloride components may be effectively removed from alkylate via a process involving the decomposition of the organic chloride to provide a dechlorinated alkylate. As disclosed herein, organic chloride components of a hydrocarbon stream (e.g., alkylate prepared by ionic liquid catalyzed alkylation) may be effectively decomposed by contacting the hydrocarbon stream with a suitable metal or metal alloy.

Feedstocks for ionic liquid catalyzed alkylation

In an embodiment, feedstocks for ionic liquid catalyzed alkylation may comprise various olefin- and isoparaffin containing hydrocarbon streams in or from one or more of the following: a petroleum refinery, a gas-to-liquid conversion plant, a coal-to-liquid conversion
5 plant, a naphtha cracker, a middle distillate cracker, a natural gas production unit, an LPG production unit, and a wax cracker, and the like.

Examples of olefin containing streams include FCC off-gas, coker gas, olefin metathesis unit off-gas, polyolefin gasoline unit off-gas, methanol to olefin unit off-gas, FCC light naphtha,
10 coker light naphtha, Fischer-Tropsch unit condensate, and cracked naphtha. Some olefin containing feed streams may contain at least one olefin selected from ethylene, propylene, butylenes, pentenes, and up to C₁₀ olefins, i.e., C₂ - C₁₀ olefins, and mixtures thereof. Such olefin containing streams are further described, for example, in U.S. Patent No. 7,572,943, the disclosure of which is incorporated by reference herein in its entirety.

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Examples of isoparaffin containing streams include, but are not limited to, FCC naphtha, hydrocracker naphtha, coker naphtha, Fisher-Tropsch unit condensate, natural gas condensate, and cracked naphtha. Such streams may comprise at least one C₄ - C₁₀ isoparaffin. In an embodiment, such streams may comprise a mixture of two or more
20 isoparaffins. In a sub-embodiment, an isoparaffin feed to the alkylation reactor during an ionic liquid catalyzed alkylation process may comprise isobutane.

Paraffin alkylation

In an embodiment, the alkylation of a mixture of hydrocarbons may be performed in a reactor
25 vessel under conditions known to produce alkylate gasoline, and the reactor vessel may be referred to herein as an alkylation reactor or alkylation zone. The alkylation conditions in the alkylation reactor are selected to provide the desired product yields and quality. The alkylation reaction in the alkylation reactor is generally carried out in a liquid hydrocarbon phase, in a batch system, a semi-batch system, or a continuous system. The catalyst volume
30 in the alkylation reactor may be in the range of 0.5 to 50 vol %, or from 1 to 10 vol %, or from 2 to 6 vol %. In an embodiment, vigorous mixing can be used to provide contact between the hydrocarbon reactants and ionic liquid catalyst over a large surface area per unit volume of the reactor vessel. The alkylation reaction temperature can be in the range from -40°C to 150°C, such as -20°C to 100°C, or -15°C to 50°C. The alkylation pressure can be

in the range from atmospheric pressure to 8000 kPa. In an embodiment the alkylation pressure is maintained at a level at least sufficient to keep the reactants in the liquid phase. The residence time of reactants in the reactor can be in the range of a second to 60 hours.

- 5 In one embodiment, the molar ratio of isoparaffin to olefin in the alkylation reactor can vary over a broad range. Generally the molar ratio of isoparaffin to olefin is in the range of from 0.5:1 to 100:1. For example, in different embodiments the molar ratio of isoparaffin to olefin is from 1:1 to 50:1, from 1.1:1 to 10:1, or from 1.1:1 to 20:1. Lower isoparaffin to olefin molar ratios will tend to produce a higher yield of higher molecular weight alkylate products, and thus can be selected when operating the alkylation reactor in a distillate mode, such as described in U.S. Patent Publication No. US20110230692A1.

Ionic liquid catalysts for hydrocarbon conversion processes

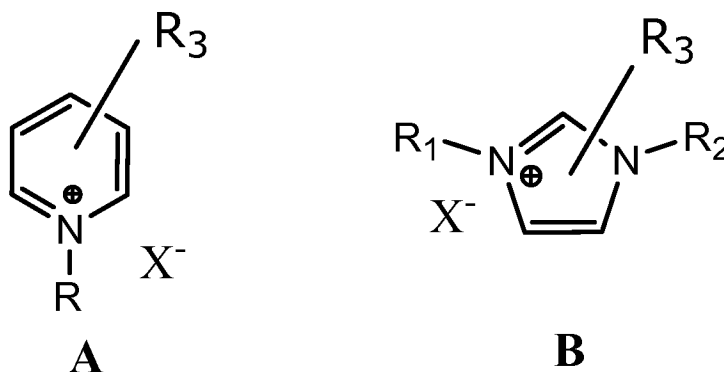
- In an embodiment, a catalyst for hydrocarbon conversion processes, such as paraffin alkylation, may be a chloride-containing ionic liquid catalyst comprised of at least two components which form a complex. A first component of the chloride-containing ionic liquid catalyst can comprise a Lewis Acid selected from components such as Lewis Acidic compounds of Group 13 metals, including aluminum halides, alkyl aluminum halides, gallium halides, alkyl gallium halides, indium halides, and alkyl indium halides (see International Union of Pure and Applied Chemistry (IUPAC), version 3, October 2005, for Group 13 metals of the periodic table). Other Lewis Acidic compounds, in addition to those of Group 13 metals, can also be used. In one embodiment the first component is aluminum halide or alkyl aluminum halide. For example, aluminum trichloride can be the first component of the chloride-containing ionic liquid catalyst.

- 25 A second component comprising the chloride-containing ionic liquid catalyst is an organic salt or mixture of salts. These salts can be characterized by the general formula Q^+A^- , wherein Q^+ is an ammonium, phosphonium, boronium, iodonium, or sulfonium cation and A^- is a negatively charged ion such as Cl^- , Br^- , ClO_4^- , NO_3^- , BF_4^- , BCl_4^- , PF_6^- , SbF_6^- , $AlCl_4^-$, TaF_6^- , $CuCl_2^-$, $FeCl_3^-$, HSO_3^- , RSO_3^- (wherein R is an alkyl group having from 1 to 12 carbon atoms), $SO_3CF_3^-$, and $^-$ sulfurtrioxyphenyl. In one embodiment, the second component is selected from those having quaternary ammonium or phosphonium halides containing one or more alkyl moieties having from 1 to 12 carbon atoms, such as, for

example, trimethylamine hydrochloride, methyltributylammonium halide, trialkylphosphonium hydrochloride, tetraalkylphosphonium chlorides, methyltrialkylphosphonium halide or substituted heterocyclic ammonium halide compounds, such as hydrocarbyl substituted pyridinium halide compounds, for example, 1-

- 5 butylpyridinium halide, benzylpyridinium halide, or hydrocarbyl substituted imidazolium halides, such as for example, 1-ethyl-3-methyl-imidazolium chloride.

In one embodiment the chloride-containing ionic liquid catalyst is selected from the group consisting of hydrocarbyl substituted pyridinium chloroaluminate, hydrocarbyl substituted
10 imidazolium chloroaluminate, quaternary amine chloroaluminate, trialkyl amine hydrogen chloride chloroaluminate, alkyl pyridine hydrogen chloride chloroaluminate, and mixtures thereof. For example, the chloride-containing ionic liquid catalyst can be an acidic haloaluminate ionic liquid, such as an alkyl substituted pyridinium chloroaluminate or an alkyl substituted imidazolium chloroaluminate of the general formulas A and B, respectively.



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In the formulas A and B, R, R₁, R₂, and R₃ are H, methyl, ethyl, propyl, butyl, pentyl or hexyl group, and X is a chloroaluminate. In the formulas A and B, R, R₁, R₂, and R₃ may or may not be the same. In one embodiment the chloride-containing ionic liquid catalyst is N-butylpyridinium chloroaluminate. Examples of highly acidic chloroaluminates are Al₂Cl₇⁻
20 and Al₃Cl₁₀⁻.

In another embodiment the chloride-containing ionic liquid catalyst can have the general formula RR'R''NH⁺ Al₂Cl₇⁻, wherein R, R', and R'' are alkyl groups containing from 1 to 12 carbons, and where R, R', and R'' may or may not be the same.

- 25 In another embodiment the chloride-containing ionic liquid catalyst can have the general formula RR'R''R'''P⁺ Al₂Cl₇⁻, wherein R, R', R'' and R''' are alkyl groups containing from 1 to 12 carbons, and wherein R, R', R'' and R''' may or may not be the same.

The presence of the first component should give the chloride-containing ionic liquid a Lewis or Franklin acidic character. Generally, the greater the mole ratio of the first component to the second component, the greater is the acidity of the chloride-containing ionic liquid catalyst. The molar ratio of the first component (metal halide) to the second component
5 (quaternary amine or quaternary phosphorus) is in the range of 2:1 to 1.1:1.

In one embodiment, the chloride-containing ionic liquid catalyst is mixed in the alkylation reactor with a hydrogen halide and/or an organic halide. The hydrogen halide or organic halide can boost the overall acidity and change the selectivity of the chloride-containing ionic
10 liquid catalyst. The organic halide can be an alkyl halide. The alkyl halides that can be used include alkyl bromides, alkyl chlorides, alkyl iodides, and mixtures thereof. A variety of alkyl halides can be used. Alkyl halide derivatives of the isoparaffins or the olefins that comprise the feed streams in the alkylation process are good choices. Such alkyl halides include, but are not limited to, isopentyl halides, isobutyl halides, butyl halides (e.g., 1-butyl
15 halide or 2-butyl halide), propyl halides and ethyl halides. Other alkyl chlorides or halides having from 1 to 8 carbon atoms can be also used. The alkyl halides can be used alone or in combination with hydrogen halide. The alkyl halide or hydrogen halide is fed to the unit by injecting the alkyl halide or hydrogen halide to the hydrocarbon feed, or to the ionic liquid catalyst or to the alkylation reactor directly. The amount of HCl or alkylation chloride usage,
20 the location of the injection, and the injection method may affect the amount of organic chloride side-product formation. The use of alkyl halides to promote hydrocarbon conversion by chloride-containing ionic liquid catalysts is taught in U.S. Patent No. 7495144 and in U.S. Patent Publication No. 20100298620A1.

It is believed that the alkyl halide decomposes under hydrocarbon conversion conditions to liberate Bronsted acids or hydrogen halides, such as hydrochloric acid (HCl) or hydrobromic acid (HBr). These Bronsted acids or hydrogen halides promote the hydrocarbon conversion reaction. In one embodiment the halide in the hydrogen halide or alkyl halide is chloride. In one embodiment the alkyl halide is an alkyl chloride, for example *t*-butyl chloride. Hydrogen
30 chloride and/or an alkyl chloride can be used advantageously, for example, when the chloride-containing ionic liquid catalyst is a chloroaluminate.

Ionic liquid catalyst regeneration

As a result of use, ionic liquid catalysts become deactivated, i.e., lose activity, and may eventually need to be replaced. However, ionic liquid catalysts are expensive and replacement adds significantly to operating expenses. Thus it is desirable to regenerate the ionic liquid catalyst on-line and reuse it in the alkylation process. The regeneration of acidic ionic liquid catalysts is taught in U.S. Patent Nos. US 7651970, US 7674739, US 7691771, US 7732363, and US 7732364.

Alkylation processes utilizing an ionic liquid catalyst form by-products known as conjunct polymers. These conjunct polymers are highly unsaturated molecules and deactivate the ionic liquid catalyst by forming complexes with the ionic liquid catalyst. A portion of used ionic liquid catalyst from the alkylation reactor is sent to a regenerator reactor (not shown), which removes the conjunct polymer from the ionic liquid catalyst and recovers the activity of the ionic liquid catalyst. The regeneration reactor contains metal components that saturates the conjunct polymers and releases the saturated polymer molecules from the ionic liquid catalyst. The regeneration can be performed either in a stirred reactor or a fixed bed reactor. For ease of operation, a fixed bed reactor may be used, even though the fixed bed regenerator reactor is more susceptible to plugging from coking, deposits of corrosion products and decomposition products derived from feed contaminants. A guard bed vessel (not shown) containing adsorbent material with appropriate pore size may be added before the regeneration reactor to minimize contaminants going into the regeneration reactor.

Processes for decomposing organic chloride in alkylate

In an embodiment, a process for treating, purifying, or dechlorinating a hydrocarbon stream, or for decomposing an organic chloride in a hydrocarbon stream, may comprise providing a hydrocarbon stream which comprises an alkylate product in combination with an organic chloride contaminant. In an embodiment, such a process may further comprise contacting the hydrocarbon stream under dechlorination conditions in a dechlorination zone with a dechlorination element, so as to decompose the organic chloride and to provide a dechlorinated alkylate product. The dechlorination element may have a surface area per unit volume in the range from 250 to 1000 m².m⁻³, or from 300 to 900 m².m⁻³. In an embodiment, the entire surface of the dechlorination element may consist essentially of solid metal.

In an embodiment, the dechlorination element may have a metal surface, and the dechlorination element as a whole, including the metal surface, may comprise a metal or metal alloy. In an embodiment, the dechlorination element may comprise from 90 to 100 wt% of the metal alloy, or from 95 to 100 wt% of the metal alloy, or from 99 to 100 wt% of the metal alloy. In an embodiment, the dechlorination element may consist essentially of the metal alloy. In an embodiment, the metal alloy may comprise from 95 to 100 wt% elemental metal, or from 97 to 100 wt% elemental metal, or from 99 to 100 wt% elemental metal. In a sub-embodiment, the elemental metal may be selected from the group consisting of Al, Co, Cr, Cu, Fe, Mg, Mn, Mo, Nb, Ni, Pb, Ta, Ti, V, W, Zr, and combinations thereof.

In contrast to conventional catalysts that have a catalytically active metal component interspersed with a carrier material, in an embodiment the dechlorination element disclosed herein may have a metal surface of uniform composition such that the dechlorination element, as assembled or manufactured, shows no substantial variation in the concentration of metal constituent(s) of the dechlorination element with respect to location thereon. In an embodiment, the dechlorination element as a whole, including the metal surface of the dechlorination element, may be of such uniform composition.

In an embodiment, the metal alloy may be selected from the group consisting of an Fe based (ferrous) alloy, a Ni based alloy, and a Cu based alloy, wherein the Fe based alloy, the Ni based alloy, and the Cu based alloy may comprise at least 50 wt% Fe, Ni, and Cu, respectively. In an embodiment, the metal alloy may comprise at least 90 wt% Fe, and an alloying element selected from the group consisting of Al, B, C, Co, Cr, Cu, Mg, Mn, Mo, N, Nb, Ni, Pb, S, Si, Ta, Ti, V, W, Zr, and combinations thereof. In an embodiment, the metal alloy may comprise a ferrous alloy, such as steel, and in a sub-embodiment the metal alloy may comprise carbon steel. In another embodiment, the metal alloy may comprise at least 60 wt% Ni, and an alloying element selected from the group consisting of Al, B, C, Co, Cr, Cu, Fe, Mg, Mn, Mo, N, Nb, Pb, S, Si, Ta, Ti, V, W, Zr, and combinations thereof. In an embodiment, the dechlorination element may comprise a commercially available alloy such as Hastelloy® or Monel®.

In an embodiment, the dechlorination element may be entirely in the solid state and the dechlorination element may be configured and/or adapted so as to present a large surface area per unit volume of the dechlorination element. As a non-limiting example, in an embodiment

the dechlorination element may be configured as at least one metal sheet. In a sub-embodiment the dechlorination element may comprise a plurality of metal sheets, wherein the plurality of metal sheets may or may not be interconnected, attached, or affixed to one another.

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In an embodiment, configurations other than metal sheets, such as plates, rings, saddle shapes, or the like, and combinations thereof, may also be used to form the dechlorination element. In an embodiment, the at least one metal sheet, plate, ring, or the like, comprising the dechlorination element may have a configuration selected from the group consisting of
10 folded, ridged, grooved, corrugated, perforated, embossed, and combinations thereof. In an embodiment, the metal sheets, plates, or the like may be tied, linked, or bundled together to provide a dechlorination element *per se*, or to provide a plurality of dechlorination modules (not shown) from which the dechlorination element may be assembled.

15 In an embodiment, the dechlorination element may be disposed within a distillation column. In an embodiment, the dechlorination element may be disposed within a lower portion only of a distillation column; or, stated differently, the dechlorination element may be confined to a lower portion of a distillation column. The location of the dechlorination element, e.g., with respect to the height of the distillation column, may define a dechlorination zone within
20 the lower portion of a distillation column.

In an embodiment, the dechlorination element may be confined to the lower half ($1/2$) of a distillation column such that the dechlorination element, and the dechlorination zone, does not extend beyond 50% of the total height of the distillation column, as measured from the
25 base of the distillation column. In a sub-embodiment, the dechlorination element may be confined to the lower one third ($1/3$) of the distillation column, such that the dechlorination element, and the dechlorination zone, does not extend beyond 34% of the total height of the distillation column. In a further sub-embodiment, the dechlorination element may be confined to the lower one quarter ($1/4$) of the distillation column, such that the dechlorination
30 element, and the dechlorination zone, does not extend beyond 25% of the total height of the distillation column. In an embodiment, the distillation column may include one or more trays within the dechlorination zone. In another embodiment, the distillation column may lack trays within the dechlorination zone. In an embodiment, the distillation column may include one or more trays disposed at an elevation above the dechlorination zone.

In an embodiment, the dechlorination element is confined to the lower portion of a distillation column, and the dechlorination element may occupy at least 50% of the cross-sectional area of the distillation column, or at least 80% of the cross-sectional area of the distillation column, or at least 95% of the cross-sectional area of the distillation column. In an
5 embodiment, the dechlorination element may occupy at least substantially the entire internal cross-sectional area of the lower portion of a distillation column. In an embodiment, the dechlorination element may be configured to allow the passage of liquid(s) and/or vapor(s) therethrough. In an embodiment, the dechlorination element may be sealed against the sides or wall of the distillation column, e.g., to prevent liquid(s) and/or vapor(s) from bypassing the
10 dechlorination element.

In an embodiment, the hydrocarbon stream, which comprises alkylate and organic chloride, may be contacted with the dechlorination element, in the substantial absence of H₂ gas, so as to decompose the organic chloride and to provide a dechlorinated alkylate product. In an
15 embodiment, the decomposition of the organic chloride, as a result of contacting the hydrocarbon stream with the dechlorination element under dechlorination conditions, generates HCl. In an embodiment, olefins may be formed from the decomposition of alkyl chlorides as a result of contacting the alkyl chlorides with the dechlorination element under dechlorination conditions.

20 In an embodiment, the dechlorination conditions during contacting the hydrocarbon stream with the dechlorination element in the dechlorination zone of a distillation column may include a temperature in the range from 200 to 600°F, or from 300 to 550°F, or from 350 to 450°F. In an embodiment, the dechlorination conditions during contacting the hydrocarbon
25 stream with the dechlorination element in the dechlorination zone may further include a dechlorination pressure in the range from atmospheric pressure to 400 psig, or from 100 to 250 psig, or from 150 to 250 psig. The dechlorination conditions and the composition of the dechlorination element may be such that the entire dechlorination element remains in the solid state during the dechlorination process.

30 In an embodiment, a hydrocarbon stream to be treated for the removal or decomposition of organic chloride may comprise a hydrocarbon stream separated from the effluent of an alkylation reactor, and the organic chloride may be decomposed in the presence of a

dechlorination element disposed within a distillation column. In an embodiment, the hydrocarbon stream may comprise alkylate from an ionic liquid catalyzed alkylation process.

5 In another embodiment, a hydrocarbon stream to be treated for the removal or decomposition of organic chloride may comprise a fraction from a distillation column, and the hydrocarbon stream may be fed from the distillation column to a dechlorination element disposed within an external (separate) dechlorination vessel, wherein such dechlorination vessel may be disposed downstream from the distillation column. Contact of the hydrocarbon stream with the dechlorination element under dechlorination conditions in the dechlorination vessel may
10 decompose the organic chloride contaminants in the hydrocarbon stream to provide a dechlorinated alkylate product. HCl, generated as a result of organic chloride decomposition, may be flushed from the dechlorination element/dechlorination vessel, e.g., via hydrocarbon vapors, and recycled to the distillation column.

15 In a further embodiment of a process for dechlorinating a hydrocarbon stream the process may comprise providing a hydrocarbon stream comprising an alkylate product in combination with an alkyl chloride contaminant. Such a process may further comprise contacting the hydrocarbon stream under dechlorination conditions in a dechlorination zone, in the substantial absence of H₂ gas, with a dechlorination element comprising from 90 to 100
20 wt% of a metal alloy to decompose the alkyl chloride and to provide a dechlorinated alkylate product. In an embodiment, the dechlorination element may have a metal surface comprising the metal alloy. The metal surface of the dechlorination element may be of uniform composition.

25 In an embodiment, the metal alloy comprising the dechlorination element may be selected from the group consisting of an Fe based alloy, a Ni based alloy, and a Cu based alloy. In an embodiment, the metal alloy may comprise from 95 to 100 wt% of an elemental metal selected from the group consisting of Al, Co, Cr, Cu, Fe, Mg, Mn, Mo, Nb, Ni, Pb, Ta, Ti, V, W, Zr, and combinations thereof. In an embodiment, the dechlorination element(s) may have
30 a surface area per unit volume in the range from 250 to 1000 m².m⁻³, or from 300 to 900 m².m⁻³.

The dechlorination zone may be defined by the location of the dechlorination element. In an embodiment, the dechlorination zone may be within a distillation column. In another embodiment, the dechlorination zone may be within a separate dechlorination vessel, e.g., in

a vessel external to a distillation column, wherein the dechlorination vessel is in fluid communication with the distillation column. In an embodiment, a plurality of dechlorination zones may be used for dechlorinating a hydrocarbon stream. As an example only, a plurality of distillation columns, such as an isostripper and a debutanizer, in a distillation train may each include a dechlorination zone. As another non-limiting example, at least one distillation column and at least one external (separate) dechlorination vessel may each have a dechlorination zone.

In embodiments wherein the dechlorination zone is located within a distillation column, the dechlorination zone may be further defined by the temperature gradient within the distillation column. In an embodiment, the dechlorination element may be confined to the lower half ($1/2$) of the distillation column. HCl generated as a result of organic chloride decomposition may be rapidly removed from the dechlorination element/dechlorination zone, and separated from the dechlorinated alkylate product, via the distillation column. In a sub-embodiment, a distillation column having an integral dechlorination element may comprise an isostripper column.

In another embodiment, a hydrocarbon stream comprising an alkylate product in combination with an alkyl chloride contaminant may comprise a bottoms fraction from a distillation column, and the dechlorination element may be disposed in a dechlorination vessel external to the distillation column. The bottoms fraction comprising the alkylate product and the alkyl chloride may be fed from the distillation column to the dechlorination vessel. In an embodiment, HCl generated as a result of the decomposition of the organic chloride may be flushed from the dechlorination zone/ dechlorination vessel via hydrocarbon vapors, and the HCl may be recycled to the distillation column. In an embodiment, such a distillation column disposed upstream from the dechlorination vessel, and which provides the bottoms fraction to the dechlorination element, may comprise an isostripper column.

In a further embodiment, a process for providing a dechlorinated alkylate product may comprise contacting an isoparaffin and an olefin with an ionic liquid catalyst in an ionic liquid alkylation zone under ionic liquid alkylation conditions, and separating a hydrocarbon stream from an effluent of the ionic liquid alkylation zone, wherein the hydrocarbon stream may comprise an alkylate product in combination with an alkyl chloride contaminant.

Such a process may further comprise feeding the hydrocarbon stream to a distillation column having a dechlorination element disposed therein, and contacting the hydrocarbon stream with the dechlorination element, under dechlorination conditions in a dechlorination zone within the distillation column, to decompose the alkyl chloride to provide a dechlorinated alkylate product. The distillation column may comprise at least one of an isostripper and a debutanizer. The dechlorination element may have a surface area per unit volume in the range from 250 to 1000 m².m⁻³, or from 300 to 900 m².m⁻³.

In an embodiment, the dechlorination element may be confined to the lower half ($1/2$) of the distillation column and the dechlorination element may occupy at least 50% of the cross-sectional area of the distillation column. In a sub-embodiment, the dechlorination element may extend no higher than about one third ($1/3$) of the total height of the distillation column, and the dechlorination element may occupy at least 80% of the cross-sectional area of the distillation column. In an embodiment, the dechlorination element may have a metal surface comprising from 95 to 100 wt% of an elemental metal selected from the group consisting of Al, Co, Cr, Cu, Fe, Mg, Mn, Mo, Nb, Ni, Pb, Ta, Ti, V, W, Zr, and combinations thereof. In an embodiment, the metal surface of the dechlorination element may be of uniform composition. In an embodiment, the metal surface of the dechlorination element may comprise a ferrous alloy. In a sub-embodiment, the dechlorination element may consist essentially of carbon steel.

Processes for dechlorinating a hydrocarbon stream comprising an alkylate product in combination with an organic chloride contaminant will now be described with reference to the drawings. Figure 1A schematically represents a process for the decomposition of organic chloride present in a hydrocarbon stream. Figure 1A also schematically represents a system for decomposing organic chloride and for providing a dechlorinated alkylate product, wherein the system comprises an ionic liquid alkylation zone, an ionic liquid/hydrocarbon separator, and a distillation column having an integral dechlorination element.

A process for the preparation of dechlorinated alkylate will now be described with reference to Figure 1A. Isoparaffin- and olefin-containing streams 30, 32, respectively, may be fed to an ionic liquid alkylation reactor 110 together with an ionic liquid catalyst 34. The ionic liquid catalyst feed to ionic liquid alkylation zone 110 may be combined with recycle ionic liquid catalyst. In an embodiment, the isoparaffin- and olefin-containing streams 30, 32,

respectively, may be combined prior to introducing them into ionic liquid alkylation reactor 110.

In an embodiment, anhydrous HCl co-catalyst or an organic chloride catalyst promoter may be combined with the ionic liquid in ionic liquid alkylation reactor 110 to attain the desired level of catalytic activity and selectivity. In an embodiment, such an organic chloride catalyst promoter may comprise an alkyl chloride, substantially as described hereinabove. Ionic liquid alkylation reactor 110 may also be referred to herein as ionic liquid alkylation zone 110.

At least one isoparaffin and at least one olefin may be contacted with ionic liquid catalyst in ionic liquid alkylation zone 110 under ionic liquid alkylation conditions. Ionic liquid alkylation conditions, feedstocks, and ionic liquid catalysts that may be suitable for performing ionic liquid alkylation reactions and processes are described, for example, hereinabove.

An effluent from ionic liquid alkylation reactor 110 may be fed via a line 36 to an ionic liquid/hydrocarbon (IL/HC) separator 120 for the separation of a hydrocarbon phase from the effluent. Non-limiting examples of separation processes that can be used for separating the hydrocarbon phase from the effluent include coalescence, phase separation, extraction, membrane separation, and partial condensation. Although IL/HC separator 120 is represented in the drawings as a single block, in practice IL/HC separator 120 may comprise, for example, one or more of the following: a settler, a coalescer, a centrifuge, a cyclone, a distillation column, a condenser, and a filter. In an embodiment, IL/HC separator 120 may comprise a gravity based settler and a coalescer disposed downstream from the gravity based settler.

IL/HC separator 120 may also be used to separate an ionic liquid phase 34' from the reactor effluent. In an embodiment, at least a portion of the ionic liquid phase 34' may be recycled to ionic liquid alkylation reactor 110. In an embodiment, a portion of the ionic liquid phase 34' from IL/HC separator 120 may be purged or withdrawn to other vessels (not shown) for ionic liquid catalyst regeneration, e.g., as described hereinabove.

The hydrocarbon phase from IL/HC separator 120 may provide a hydrocarbon stream comprising an alkylate product in combination with an organic chloride contaminant. In an embodiment, the organic chloride contaminant may comprise an organic chloride catalyst promoter fed to ionic liquid alkylation zone 110. The organic chloride contaminant may
5 comprise more than one species. As a non-limiting example, the organic chloride contaminant(s) may comprise one or more C₂ - C₈ alkyl chlorides.

The hydrocarbon stream, comprising an alkylate product in combination with an organic chloride contaminant, may be fed via a line 38 to a distillation column or unit 130. The
10 alkylate product of the hydrocarbon stream may comprise, e.g., C₅ - C₁₁ alkanes, such as C₇ - C₈ isoparaffins. The hydrocarbon stream fed to distillation column 130 may also contain isobutene (i-C₄). In an embodiment, the hydrocarbon stream fed to distillation column 130 may have an organic chloride (contaminant) concentration in the range from 100 to 4000 ppmw.

15 The hydrocarbon stream fed to distillation column 130 may be contacted with a dechlorination element 140 disposed therein to effect the decomposition of the organic chloride contaminant and to provide dechlorinated alkylate 42. The decomposition of the organic chloride contaminant within distillation column 130 may generate HCl. The HCl
20 may be continuously removed from the dechlorination zone by distillation column 130 as overhead.

In an embodiment, dechlorinated alkylate 42 may be taken as a bottoms fraction from distillation column 130. Distillation column 130 may be used in conjunction with a reboiler
25 150, as is well known in the art. In an embodiment, the dechlorinated alkylate product 42 may have an organic chloride concentration less than half (< 50%) that of the hydrocarbon stream prior to treatment with dechlorination element 140; and in another embodiment the dechlorinated alkylate product 42 may have an organic chloride concentration at least one order of magnitude less than that of the hydrocarbon stream prior to treatment with
30 dechlorination element 140. In an embodiment, the dechlorinated alkylate product 42 may have an organic chloride concentration typically in the range from 10 to 100 ppmw, or from 10 to 50 ppmw.

Dechlorination element 140 may be confined to the lower portion of distillation column 130, and dechlorination element 140 may occupy at least 50% of the cross-sectional area of the distillation column, or at least 80% of the cross-sectional area of distillation column 130, or at least 95% of the cross-sectional area of distillation column 130. In an embodiment,

5 dechlorination element 140 may occupy at least substantially the entire internal cross-sectional area of the lower portion of distillation column 130. In an embodiment, dechlorination element 140 as a whole may be configured so as to allow the passage of liquid(s) and/or vapor(s) therethrough. In an embodiment, dechlorination element 140 may be sealed against the sides or wall of distillation column 130, e.g., to prevent liquid(s) and/or
10 vapor(s) from bypassing dechlorination element 140.

Dechlorination element 140 may define a dechlorination zone within distillation column 130. In an embodiment, the dechlorination zone may extend no higher than about one half ($1/2$) of the total height of distillation column 130 (as measured from the base of the distillation
15 column), or no higher than about one third ($1/3$) of the total height of distillation column 130, or no higher than about one quarter ($1/4$) of the total height of distillation column 130.

An upper portion of distillation column 130 that lacks a dechlorination element 140 may be ineffective in decomposing organic chlorides (e.g., alkyl chlorides). In an embodiment, the
20 upper portion of distillation column 130 may have one or more trays (not shown) located above the dechlorination zone (i.e., above dechlorination element 140), while a lower portion of distillation column 130 that corresponds to the dechlorination zone may lack trays. In another embodiment, a lower portion of distillation column 130 may have one or more trays located within the dechlorination zone.

25 In an embodiment, dechlorination conditions during contacting the hydrocarbon stream with dechlorination element 140 in the dechlorination zone of distillation column 130 may include a temperature in the range from 200 to 600°F, or from 300 to 550°F, or from 350 to 450°F.

In an embodiment, the dechlorination conditions during contacting the hydrocarbon stream
30 with dechlorination element 140 in the dechlorination zone may further include a dechlorination pressure in the range from atmospheric pressure to 400 psig, or from 100 to 250 psig, or from 150 to 250 psig.

In an embodiment, dechlorination element 140 may comprise a metal or metal alloy. Such metal or metal alloy may be in the solid state and may have a pre-defined, high surface area configuration. In an embodiment, a metal or metal alloy may be configured for placement within a lower portion of distillation column 130. Non-limiting examples of configurations for dechlorination element 140 include folded, ridged, grooved, corrugated, perforated, or embossed metal sheet(s), plates, rings, or the like, and combinations thereof.

In an embodiment, dechlorination element 140 may have a metal surface, and dechlorination element 140 as a whole, including the metal surface, may comprise a metal or metal alloy. In an embodiment, dechlorination element 140 may comprise from 90 to 100 wt% of the metal alloy, or from 95 to 100 wt% of the metal alloy, or from 99 to 100 wt% of the metal alloy. In an embodiment, dechlorination element 140 may consist essentially of the metal alloy. In an embodiment, the metal alloy may comprise from 95 to 100 wt% elemental metal, or from 97 to 100 wt% elemental metal, or from 99 to 100 wt% elemental metal. In a sub-embodiment, the elemental metal may be selected from the group consisting of Al, Co, Cr, Cu, Fe, Mg, Mn, Mo, Nb, Ni, Pb, Ta, Ti, V, W, Zr, and combinations thereof.

In an embodiment, dechlorination element 140 may have a metal surface of uniform composition, such that dechlorination element 140, as assembled or manufactured, shows no substantial variation in the concentration of metal constituent(s) of dechlorination element 140 with respect to location thereon. In an embodiment, dechlorination element 140 as a whole, including the metal surface of dechlorination element 140, may be of such uniform composition.

In an embodiment, the metal alloy may be selected from the group consisting of an Fe based alloy, a Ni based alloy, and a Cu based alloy, wherein the Fe based alloy, the Ni based alloy, and the Cu based alloy may comprise at least 50 wt% Fe, Ni, and Cu, respectively. In an embodiment, the metal alloy may comprise at least 90 wt% Fe, and an alloying element selected from the group consisting of Al, B, C, Co, Cr, Cu, Mg, Mn, Mo, N, Nb, Ni, Pb, S, Si, Ta, Ti, V, W, Zr, and combinations thereof. In an embodiment, the metal alloy may comprise a ferrous alloy, and in a sub-embodiment the metal alloy may comprise carbon steel. In another embodiment, the metal alloy may comprise at least 60 wt% Ni, and an alloying element selected from the group consisting of Al, B, C, Co, Cr, Cu, Fe, Mg, Mn, Mo, N, Nb, Pb, S, Si, Ta, Ti, V, W, Zr, and combinations thereof.

In an embodiment, the hydrocarbon stream feed to distillation column 130 may comprise the hydrocarbon phase from IL/HC separator 120. In an embodiment, separation of the effluent from ionic liquid alkylation reactor 110 into a hydrocarbon phase and an ionic liquid phase by IL/HC separator 120 may be incomplete, such that the hydrocarbon phase from IL/HC separator 120 may comprise ionic liquid catalyst, typically in relatively small or trace amounts. Accordingly, in an embodiment, the hydrocarbon stream feed to distillation column 130 may comprise ionic liquid catalyst together with alkylate, unreacted isobutane, and organic chloride (e.g., alkyl chloride) contaminants. While not being bound by theory, the presence of an ionic liquid catalyst (e.g., as described hereinabove) in the hydrocarbon feed to dechlorination element 140 within distillation column 130 may contribute to the dechlorination process. Stated differently, in an embodiment, the dechlorination of the hydrocarbon feed may be promoted, induced, or enhanced by the presence of ionic liquid catalyst, for example, during the step of contacting the hydrocarbon stream with dechlorination element 140.

In an embodiment, the hydrocarbon stream feed to distillation column 130 may be at an elevation above the level of dechlorination element 140, i.e., above the uppermost part of dechlorination element 140. In other embodiments, the hydrocarbon stream feed to distillation column 130 may be at or below the level of the uppermost part of dechlorination element 140.

Although distillation column 130 is shown in the drawings as a single block, distillation column 130 may represent a distillation train, and processes disclosed herein may use a plurality of distillation columns in conjunction with one another for the separation of one or more fractions or products from alkylate-containing hydrocarbon stream(s). As a non-limiting example, in an embodiment distillation column 130 of Figures 1A-1C may include an isostripper column. In another embodiment, distillation column 130 of Figures 1A-1C may represent or include an isostripper and a debutanizer.

Figure 1B schematically represents a process for the decomposition of organic chloride present in a hydrocarbon stream according to another embodiment. Figure 1B also schematically represents a system for decomposing organic chloride and for providing a dechlorinated alkylate product, wherein the system comprises an ionic liquid alkylation zone,

an ionic liquid/hydrocarbon separator, a distillation column, and an external dechlorination vessel comprising a dechlorination element.

In a process for preparing dechlorinated alkylate according to Figure 1B, isoparaffin- and olefin-containing streams 30, 32, respectively, may be fed to ionic liquid alkylation zone 110 together with ionic liquid catalyst 34, and effluent from ionic liquid alkylation zone 110 may be phase separated via IL/HC separator 120, essentially as described with reference to Figure 1A, *supra*. The hydrocarbon phase from IL/HC separator 120 may be fed to a distillation column or unit 130. A fraction from distillation column 130 provides a hydrocarbon stream 40 comprising alkylate product and an organic chloride contaminant. In an embodiment, hydrocarbon stream 40 may comprise a bottoms fraction from distillation column 130.

Hydrocarbon stream 40 may be fed, via reboiler 150, to a dechlorination element 140 for decomposition of the organic chloride contaminant to provide a dechlorinated alkylate product 42. Dechlorination element 140 may be disposed or housed within a dechlorination vessel 142, wherein dechlorination vessel 142 is separate from distillation column 130 and located downstream from reboiler 150. Dechlorination element 140 housed within dechlorination vessel 142 may comprise a solid metal or metal alloy, and may have a metal surface of uniform composition as well as other features and characteristics as described, for example, with respect to Figure 1A, *supra*. Dechlorination element 140 may have a large surface area configuration, e.g., having a surface area per unit volume in the range from 250 to 1000 m².m⁻³, or from 300 to 900 m².m⁻³.

Dechlorination element 140 may define a dechlorination zone within dechlorination vessel 142. In an embodiment, dechlorination conditions within dechlorination vessel 142 during contacting the hydrocarbon stream with dechlorination element 140 may include a dechlorination temperature in the range from 200 to 600°F, or from 300 to 550°F, or from 350 to 450°F. In an embodiment, the dechlorination conditions may further include a dechlorination pressure in the range from atmospheric pressure to 400 psig, or from 100 to 250 psig, or from 150 to 250 psig. In an embodiment, the dechlorination conditions within dechlorination vessel 142 may still further include an LHSV in the range from 0.1 to 100 hr⁻¹, or from 0.5 to 50 hr⁻¹, or from 0.5 to 20 hr⁻¹.

According to another embodiment, Figure 1C schematically represents a process for the decomposition of organic chloride present in a hydrocarbon stream. Figure 1C also schematically represents a system for decomposing organic chloride and for providing a dechlorinated alkylate product, wherein the system comprises an ionic liquid alkylation zone,
5 an ionic liquid/hydrocarbon separator, a distillation column, and an external dechlorination vessel comprising a dechlorination element.

A process for preparing dechlorinated alkylate according to Figure 1C may proceed generally as described hereinabove with reference to Figure 1B, with the exception that dechlorination
10 element 140 is disposed upstream from reboiler 150, such that hydrocarbon stream 40 may be fed directly from distillation column 130 to dechlorination vessel 142 so as to contact dechlorination element 140 under dechlorination conditions, and dechlorinated alkylate 42 may be obtained as product via reboiler 150. Dechlorination element 140 housed within
15 dechlorination vessel 142 may comprise a solid metal or metal alloy, and may have a metal surface of uniform composition as well as other features and characteristics as described, for example, with respect to Figure 1A, *supra*.

The dechlorination conditions within dechlorination vessel 142 for the embodiment of Figure 1C may include a dechlorination temperature in the range from 200 to 600°F, or from 300 to
20 550°F, or from 350 to 450°F; a dechlorination pressure in the range from atmospheric pressure to 400 psig, or from 100 to 250 psig, or from 150 to 250 psig; and an LHSV in the range from 0.1 to 100 hr⁻¹, or from 0.5 to 50 hr⁻¹, or from 0.5 to 20 hr⁻¹.

While not being bound by theory, the presence of ionic liquid catalyst in hydrocarbon feed 40
25 to dechlorination element 140 in the embodiments of Figures 1B and 1C may contribute to the dechlorination of the alkylate product. That is to say, in an embodiment, dechlorination processes as disclosed herein may be promoted, induced, or enhanced by the presence of ionic liquid catalyst in hydrocarbon feed 40.

30

EXAMPLES

Example 1: Continuous flow test at 400°F using carbon steel for dechlorination of alkylate from an ionic liquid alkylation reactor

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An alkylate product obtained from an ionic liquid catalyzed alkylation reactor had a chloride content as shown in Table 1.

Table 1. *Chloride content of ionic liquid derived alkylate

10

Alkylate feed Cl species	Cl concentration (ppm)
<i>t</i> -BuCl	42
<i>s</i> -BuCl	23
Other Cl	179
Total Cl	244

* Total Cl was measured by X-Ray Fluorescence, *t*-BuCl and *s*-BuCl were measured by GC, and Other Cl was calculated by difference.

15 The alkylate was fed upflow with N₂ carrier gas (2:1 molar ratio of N₂:alkylate) to a ¾" OD reactor, containing 17 cc (*ca.* 0.3 lb.) of carbon steel wool, at flow rates ranging from 0.3 hr⁻¹ to 10 hr⁻¹ LHSV, a temperature of 400 °F, and a pressure of 400 psig. The surface area of the carbon steel was estimated (by geometry) to be 2 m²/lb. The liquid yield and total Cl content (X-Ray Fluorescence) of the treated product for each flow rate were determined.

20

As shown in Figure 2, contacting the alkylate with carbon steel at 400°F decreased the chloride content of the product to less than 100 ppm. Residence times were in the range from 0.2 to 1 hour; the reduction of chloride in the alkylate was independent of residence time over the stated range. The liquid yield of the product for all flow rates in this Example was greater than 95%.

25

Example 2: Continuous flow test at 200°F and 300°F using carbon steel for dechlorination of alkylate

The procedure of Example 1 was repeated, using the same pressure and flow rates, at
5 temperatures of 200°F and 300°F instead of 400°F. As shown in Figure 2, at a temperature of 300°F the chloride concentration in the alkylate was reduced to less than 200 ppm. This amount of reduction in chloride concentration was observed for the shortest residence time examined (0.2 hour), and the conversion of chloride in the alkylate was somewhat higher for longer residence times of up to 1 hour. The liquid yield of the product for all flow rates at a
10 temperature of 300 °F was greater than 95%. At a temperature of 200°F no substantial conversion (reduction) of chloride in the alkylate was observed.

The transitional term "comprising," which is synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, unrecited
15 elements or method steps. The transitional phrase "consisting of" excludes any element, step, or ingredient not specified in the claim. The transitional phrase "consisting essentially of" limits the scope of a claim to the specified materials or steps and those that do not materially affect the basic and novel characteristic(s) defined by such claim.

20 Although the processes disclosed herein are described primarily with respect to organic chloride decomposition in liquid fuel produced via ionic liquid catalyzed alkylation, such processes may also be applied to dechlorinating other hydrocarbon streams and for the production of other products. Similarly, the processes disclosed herein are described primarily with respect to organic chlorides, although such processes may also be applied to
25 other halides.

For the purposes of this specification and appended claims, unless otherwise indicated, all numbers expressing quantities, percentages or proportions, and other numerical values used in the specification and claims, are to be understood as being modified in all instances by the
30 term "about." Furthermore, all ranges disclosed herein are inclusive of the endpoints and are independently combinable. Whenever a numerical range with a lower limit and an upper limit are disclosed, any number falling within the range is also specifically disclosed.

Any term, abbreviation or shorthand not defined is understood to have the ordinary meaning used by a person skilled in the art at the time the application is filed. The singular forms “a,” “an,” and “the,” include plural references unless expressly and unequivocally limited to one instance.

5

All of the publications, patents and patent applications cited in this application are herein incorporated by reference in their entirety to the same extent as if the disclosure of each individual publication, patent application or patent was specifically and individually indicated to be incorporated by reference in its entirety.

10

Many modifications of the exemplary embodiments disclosed above will readily occur to those skilled in the art. Accordingly, this disclosure is to be construed as including all structure and methods that fall within the scope of the appended claims. Unless otherwise specified, the recitation of a genus of elements, materials or other components, from which an individual component or mixture of components can be selected, is intended to include all possible sub-generic combinations of the listed components and mixtures thereof.

15

Numerous variations to the disclosed embodiments are possible in light of the teachings described herein. It is therefore understood that within the scope of the following claims, the disclosed processes may be practiced otherwise than as specifically described or exemplified herein.

20

WHAT IS CLAIMED IS:

1. A dechlorination process, comprising:
 - a) providing a hydrocarbon stream comprising an alkylate product in combination with an organic chloride contaminant; and
 - b) contacting the hydrocarbon stream under dechlorination conditions in a dechlorination zone with a dechlorination element having a surface area per unit volume in the range from 250 to 1000 m².m⁻³ to decompose the organic chloride and to provide a dechlorinated alkylate product, wherein the dechlorination element has a metal surface comprising a metal alloy.
2. The process according to claim 1, wherein the dechlorination element comprises from 90 to 100 wt% of the metal alloy.
3. The process according to claim 1, wherein:
 - the metal surface of the dechlorination element is of uniform composition, and
 - the metal alloy is selected from the group consisting of an Fe based alloy, a Ni based alloy, and a Cu based alloy.
4. The process according to claim 1, wherein the metal alloy comprises at least 90 wt% Fe, and an alloying element selected from the group consisting of Al, B, C, Co, Cr, Cu, Mg, Mn, Mo, N, Ni, Nb, Pb, S, Si, Ta, Ti, V, W, Zr, and combinations thereof.
5. The process according to claim 1, wherein the metal surface of the dechlorination element consists essentially of the metal alloy.
6. The process according to claim 5, wherein the metal alloy comprises carbon steel.
7. The process according to claim 1, wherein the dechlorination element is configured as at least one metal sheet.
8. The process according to claim 7, wherein said metal sheet has a configuration selected from the group consisting of folded, ridged, grooved, corrugated, perforated, embossed, and combinations thereof.

9. The process according to claim 1, wherein the dechlorination element is disposed within a distillation column.
10. The process according to claim 9, wherein step a) comprises:
- I) contacting an isoparaffin and an olefin with an ionic liquid catalyst in an ionic liquid alkylation zone under ionic liquid alkylation conditions, and
 - II) separating the hydrocarbon stream from an effluent of the ionic liquid alkylation zone, and wherein the distillation column comprises at least one of an iso stripper and a debutanizer.
11. The process according to claim 1, wherein:
- the hydrocarbon stream comprises a fraction from a distillation column, and
 - the dechlorination element is disposed in a dechlorination vessel external to the distillation column.
12. The process according to claim 1, wherein:
- step b) comprises contacting the hydrocarbon stream with the dechlorination element in the substantial absence of H₂ gas, and
 - the decomposition of the organic chloride generates HCl.
13. A dechlorination process, comprising:
- a) providing a hydrocarbon stream comprising an alkylate product in combination with an alkyl chloride contaminant; and
 - b) contacting the hydrocarbon stream under dechlorination conditions in a dechlorination zone, in the substantial absence of H₂ gas, with a dechlorination element comprising from 90 to 100 wt% of a metal alloy to decompose the alkyl chloride and to provide a dechlorinated alkylate product, wherein:
 - the dechlorination element has a metal surface of uniform composition comprising the metal alloy,
 - the dechlorination element has a surface area per unit volume in the range from 250 to 1000 m².m⁻³, and
 - the metal alloy comprises from 95 to 100 wt% of an elemental metal selected from the group consisting of Al, Co, Cr, Cu, Fe, Mg, Mn, Mo, Nb, Ni, Pb, Ta, Ti, V, W, Zr, and combinations thereof.

14. The process according to claim 13, wherein:
the dechlorination element is disposed within a distillation column,
the dechlorination element is confined to the lower half ($1/2$) of the distillation column,
and
the distillation column comprises at least one of an isostripper and a debutanizer.
15. The process according to claim 13, wherein:
the hydrocarbon stream comprises a bottoms fraction from a distillation column, and
the dechlorination element is housed in a dechlorination vessel external to the distillation column.
16. The process according to claim 13, wherein:
the dechlorination element consists essentially of the metal alloy, and
the metal alloy is selected from the group consisting of an Fe based alloy, a Ni based alloy, and a Cu based alloy.
17. A dechlorination process, comprising:
a) contacting an isoparaffin and an olefin with an ionic liquid catalyst in an ionic liquid alkylation zone under ionic liquid alkylation conditions;
b) separating a hydrocarbon stream from an effluent of the ionic liquid alkylation zone, wherein the hydrocarbon stream comprises an alkylate product in combination with an alkyl chloride contaminant;
c) feeding the hydrocarbon stream to a distillation column having a dechlorination element disposed therein; and
d) contacting the hydrocarbon stream with the dechlorination element under dechlorination conditions in a dechlorination zone within the distillation column to decompose the alkyl chloride so as to generate HCl and to provide a dechlorinated alkylate product, wherein:
the dechlorination element has a metal surface of uniform composition comprising from 95 to 100 wt% of an elemental metal selected from the group consisting of Al, Co, Cr, Cu, Fe, Mg, Mn, Mo, Nb, Ni, Pb, Ta, Ti, V, W, Zr, and combinations thereof, and
the dechlorination element has a surface area per unit volume in the range from 250 to 1000 $\text{m}^2.\text{m}^{-3}$.

18. The process according to claim 17, wherein:
the dechlorination element is confined to the lower half ($1/2$) of the distillation column,
and
the dechlorination element occupies at least 50% of the cross-sectional area of the distillation column.
19. The process according to claim 18, wherein:
the metal surface of the dechlorination element comprises a ferrous alloy, and
the dechlorination element occupies at least 80% of the cross-sectional area of the distillation column.
20. The process according to claim 19, wherein the distillation column comprises at least one of an isostripper and a debutanizer.

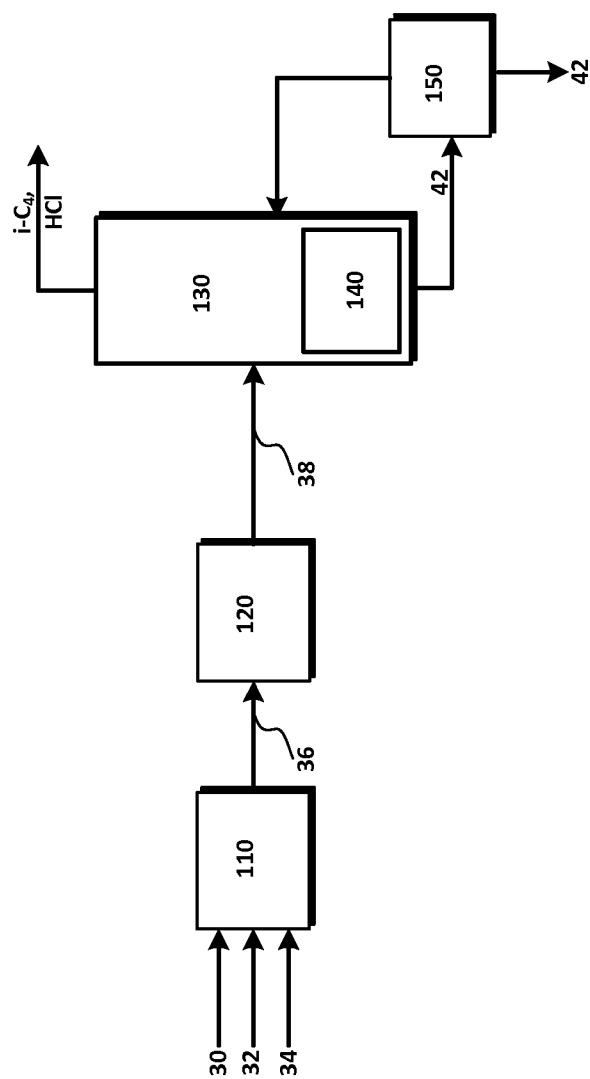


FIG. 1A

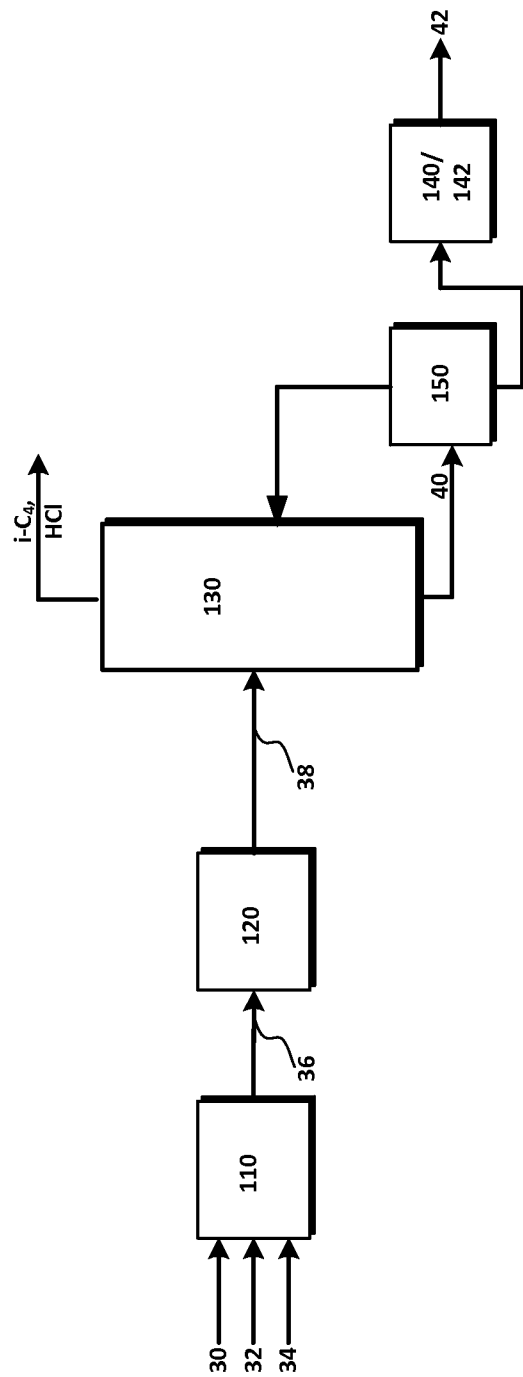


FIG. 1B

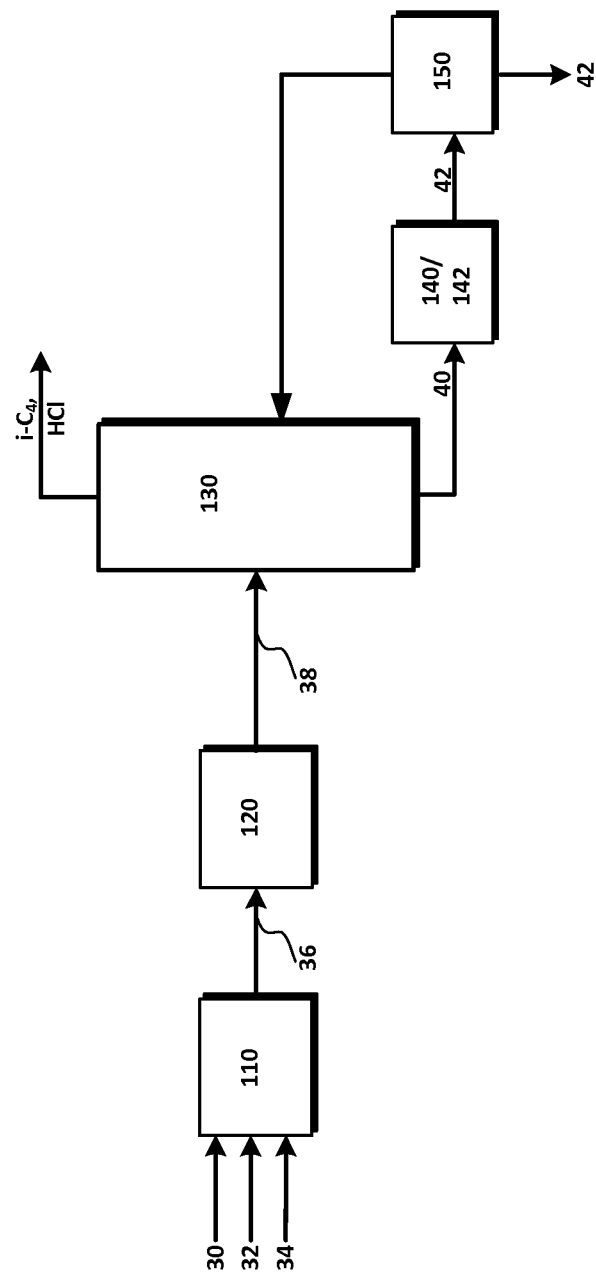
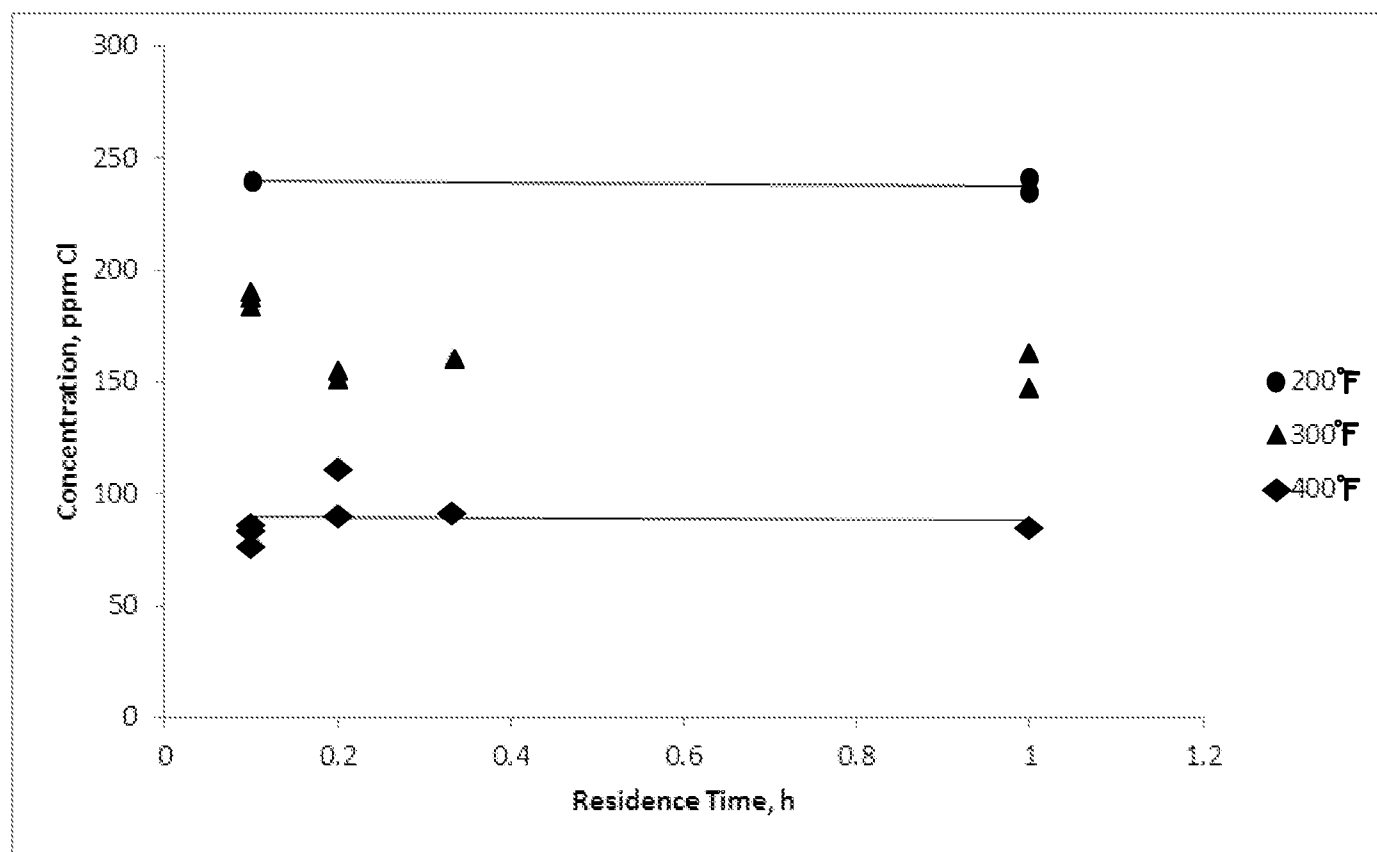


FIG. 1C

**FIG. 2**

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/017256

A. CLASSIFICATION OF SUBJECT MATTER INV. C10G29/04 C10G29/16 C10G29/20 C10G53/02 C07C2/58 B01D3/00 ADD. According to International Patent Classification (IPC) or to both national classification and IPC														
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) C10G C07C B01D Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data														
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category*</th> <th style="width: 70%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width: 20%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>US 2014/171720 A1 (ZHAN BI-ZENG [US] ET AL) 19 June 2014 (2014-06-19) figure 1 paragraphs [0029] - [0041] examples 3-4; tables 2-5 -----</td> <td style="text-align: center; vertical-align: top;">1-20</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>US 2013/001133 A1 (ZHAN BI-ZENG [US] ET AL) 3 January 2013 (2013-01-03) figure 1 paragraphs [0041] - [0055] examples 1-4 -----</td> <td style="text-align: center; vertical-align: top;">1-20</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>US 2009/163750 A1 (TIMKEN HYE-KYUNG C [US] ET AL) 25 June 2009 (2009-06-25) examples 1-5 -----</td> <td style="text-align: center; vertical-align: top;">1-20</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 2014/171720 A1 (ZHAN BI-ZENG [US] ET AL) 19 June 2014 (2014-06-19) figure 1 paragraphs [0029] - [0041] examples 3-4; tables 2-5 -----	1-20	X	US 2013/001133 A1 (ZHAN BI-ZENG [US] ET AL) 3 January 2013 (2013-01-03) figure 1 paragraphs [0041] - [0055] examples 1-4 -----	1-20	A	US 2009/163750 A1 (TIMKEN HYE-KYUNG C [US] ET AL) 25 June 2009 (2009-06-25) examples 1-5 -----	1-20
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Date of the actual completion of the international search 18 May 2015		Date of mailing of the international search report 26/05/2015												
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2015/017256

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