The term “thermal decomposition” shall for convenience be used broadly for any decomposition process, in which a material is partially decomposed at elevated temperature (typically 250°C to 800°C or perhaps 1000°C), in the presence of substoichiometric amount of oxygen (including no oxygen). The product will typically be a combined liquid and gaseous stream, as well as an amount of solid char. The term shall be construed to included processes known as pyrolysis, partial combustion, or hydrothermal liquefaction.

The unit “Barg”, shall in compliance with the practice of the field be used to denote Bar, gauge, i.e. the pressure relative to atmospheric pressure.

BRIEF SUMMARY

In an aspect of the present disclosure, there is provided a process for conversion of a hydrocarbonaceous feed comprising at least 10 ppm_w, 100 ppm_w or 500 ppm_w and less than 1000 ppm_w, 5000 ppm_w or 10000 ppm_w of one or more halides, and at least 20 ppm_w, 100 ppm_w or 500 ppm_w and less than 1000 ppm_w, 5000 ppm_w or 10000 ppm_w organically bound nitrogen, to a hydrocarbon product stream by hydrotreatment, under effective hydrotreatment conditions, in the presence of a material catalytically active in hydrotreatment and an amount of hydrogen, wherein said conversion provides a mixed product stream comprises an amount of ionic halides and an amount of ammonia, said process comprising the steps of

a) separating in a stripping process at a first separation temperature the mixed product stream to provide an overhead stream and a bottoms stream,
b) combining the overhead stream with an amount of wash water and
c) separating in a second separation step the combined overhead stream and wash water in a non-polar stream of hydrocarbon product and a polar stream of wash water comprising ammonium halides,

characterized in that the first separation temperature being above the precipitation temperature of the ammonium halides present in the mixed product stream.

In another aspect of the present disclosure, there is provided a process for conversion of a raw feed stream rich in molecules comprising C, H, N and one or more halides, and optionally O, Si, and other elements, said process comprising

i. a step of thermal decomposition of said raw feed stream, to provide a precursor to a hydrocarbonaceous feed or a hydrocarbonaceous feed,

ii. optionally a step of pre-treatment, purifying the precursor to hydrocarbonaceous feed to provide the hydrocarbonaceous feed

iii. a hydrotreatment step for converting the hydrocarbonaceous feed in the presence of hydrogen, in accordance with any of the previous claims, to provide a hydrocarbon product stream.

In a further aspect of the present disclosure, there is provided a system for hydrotreatment of a hydrocarbonaceous stream comprising

a) a hydrotreatment reactor containing a material catalytically active in hydrotreatment, said hydrotreatment reactor comprising an inlet for introducing a hydrogen enriched hydrocarbon stream and an outlet for withdrawing a first hydrocarbon product stream,

b) a first means of separation having at least an inlet, an overhead outlet and a bottoms outlet,

c) a means of mixing having two inlets and an outlet,

d) a second means of separation, having an inlet and a liquid polar phase outlet, liquid non-polar phase outlet and gas phase outlet,

wherein said outlet for withdrawing a first product stream is in fluid communication with the inlet of said first means of separation,

wherein said overhead outlet is in fluid communication with the inlet of said first inlet of the means of mixing,

wherein a source of water is in fluid communication with the second inlet of the means of mixing,

wherein the outlet of the means of mixing is in fluid communication with the inlet of the second means of separation and

wherein at least one of the bottoms outlet and the liquid non-polar phase outlet is in fluid communication with a hydrocarbon product outlet or a hydrocarbon fractionator inlet.

A broad example of the present disclosure relates to a process for conversion of a hydrocarbonaceous feed comprising at least 10 ppm_w, 100 ppm_w or 500 ppm_w and less than 1000 ppm_w, 5000 ppm_w or 10000 ppm_w of one or more halides, and at least

20 ppm_w, 100 ppm_w or 500 ppm_w and less than 1000 ppm_w, 5000 ppm_w or 10000 ppm_w organically bound nitrogen, to a hydrocarbon product stream by hydrotreatment, in the presence of a material catalytically active in hydrotreatment and an amount of hydrogen, wherein said hydrocarbon product stream comprises an amount of ionic halides and an amount of ammonia, said process comprising the steps of

a) separating in a stripping process at a first separation temperature the mixed product stream to provide an overhead stream and a bottoms stream,
b) combining the overhead stream with an amount of wash water and
c) separating in a second separation step the combined overhead stream and wash water in a non-polar stream of hydrocarbon product and a polar stream of wash water comprising ammonium halides,

characterized in that the first separation temperature being above the precipitation temperature of the ammonium halides present in the mixed product stream.

This has the associated benefit of such a method removing halides, especially chloride from the bottoms stream from the first separation step and subsequently from the non-polar stream of the second separation step, while maintaining a temperature where ammonia and halides are gaseous until an amount of water is available to collect ammonium halides in solution, and thus avoid precipitation of solid ammonium halides on the inner surfaces of the process equipment, by either keeping it in the gas phase or

dissolved in liquid water. Furthermore, by the separation before the addition of wash water, the amount of hydrocarbons associated to the stream to be washed by an amount of water is reduced, and thus amount of water required for this washing is also reduced.

In a further example said stripping process employs hydrogen, steam, methane or nitrogen as a stripping medium. These stripping media have the associated benefits of being available in specific processes. Hydrogen is also a reagent and may be beneficial since no additional reagents are added to the process and as such it is the preferred stripping medium. Steam may be conveniently compatible with the later water addition and methane and nitrogen may also be beneficial due to availability in specific processes.

In a further example the temperature of said first separation step is above 280°C, 300°C or 320°C. This choice of temperature has the benefit of being conveniently above the precipitation temperature of the ammonium halides, such that these are maintained in gas phase until combination with water.

In a further example the temperature of said first separation step is below the temperature at which 30%, 50% or 80% of the mixed product stream boils. This choice of temperature has the benefit of ensuring that at least 70%, 50% or 20% of the mixed product stream is withdrawn as a liquid from the first separator, to minimize the size of equipment in the overhead stream.

In a further example said polar stream of wash water comprising ammonium halides is directed to a means of concentrating, to provide a stream of purified water and a stream of brine having a concentration of ammonium halides being more than 2 times, 5 times or 10 times and less than 50 times or 100 times above that of the polar stream of wash water comprising ammonium halides. This has the benefit of reducing the amount of wash water consumed by the process and the amount of waste water generated by the process, which is especially relevant if the weight ratio between wash water and hydrocarbon product stream water is above 1:10, 1:5 or 1:2 such as up to 1:1, 2:1 or 10:1.

In a further example relates to a process for conversion of a raw feed stream rich in molecules comprising C, H, N and one or more halides, and optionally O, Si, and other elements, said process comprising

i. a step of thermal decomposition of said raw feed stream, to provide a precursor to a hydrocarbonaceous feed or a hydrocarbonaceous feed,
ii. optionally a step of pre-treatment, purifying the precursor to hydrocarbonaceous feed to provide the hydrocarbonaceous feed
iii. a hydrotreatment step for converting the hydrocarbonaceous feed in the presence of hydrogen, in accordance with any of the previous claims, to provide a hydrocarbon product stream.

This has the associated benefit of converting a raw feed stream of low value to a hydrocarbon product stream suitable for further processing.

In a further example said raw feed stream is as a mixture rich in plastic, lignin, straw, lignocellulosic biomass, halide contaminated waste oils or aquatic biological material. This has the associated benefit of transforming such inexpensive or greenhouse gas emission favorable raw materials into a valuable purified hydrocarbon.

In a further example said hydrotreatment step is followed by the step of directing the hydrocarbon product and/or the bottoms stream to a steam-cracking process. This has the associated benefit of providing a raw material for petrochemical processes, from e.g. waste products, biological material or low-cost resources by the steam cracking process which is well suited for providing e.g. alkenes for downstream processing, such as production of polymers.

A further example relates to a system for hydrotreatment of a hydrocarbonaceous stream comprising

(a) a hydrotreatment reactor containing a material catalytically active in hydrotreatment, said hydrotreatment reactor comprising an inlet for introducing a hydrogen enriched hydrocarbon stream and an outlet for withdrawing a first hydrocarbon product stream,
(b) a first means of separation having at least an inlet, an overhead outlet and a bottoms outlet,
(c) a means of mixing having two inlets and an outlet,

(d) a second means of separation, having an inlet and a liquid polar phase outlet, liquid non-polar phase outlet and gas phase outlet,

wherein said outlet for withdrawing a first product stream is in fluid communication with the inlet of said first means of separation,

wherein said overhead outlet is in fluid communication with the inlet of said first inlet of the means of mixing,

wherein a source of water is in fluid communication with the second inlet of the means of mixing,

wherein the outlet of the means of mixing is in fluid communication with the inlet of the second means of separation and

wherein at least one of the bottoms outlet of the first means of separation and the liquid non-polar phase outlet of the second means of separation is in fluid communication with a hydrocarbon product outlet or a hydrocarbon fractionator inlet.

This system has the associated benefit of being well suited for hydrotreatment with purification of the product hydrocarbon stream and the bottoms stream, minimizing the equipment required to be made of high grade steel.

In a further example of said system for hydrotreatment of a hydrocarbonaceous stream, said first means of separation is a stripper further having a stripping medium inlet. Such a system has the associated benefit of the stripping medium driving dissolved gases, such as ammonia and inorganic halides out of the liquid phase of the hydrocarbon product stream.

In a further example said system for hydrotreatment of a hydrocarbonaceous stream further comprises a means of concentrating, having an inlet, a concentrated brine outlet and a purified water outlet,

and the liquid polar phase outlet of the means of separation is in fluid communication with the inlet of the means of concentrating,

wherein the purified water outlet of the means of concentrating is in fluid communication with a second inlet of the means of mixing optionally in combination with a further source of purified water

and wherein the liquid non-polar phase outlet of the means of phase separation is configured for providing a hydrocarbon product. This system has the associated benefit of