

states, it is necessary to separate these products from the hydrocarbon materials. In many cases, a gravimetric separation, such as centrifugation or filtering, can separate the organic, upgraded oil, from the salt phase, metallic phase, and organic solids which may be formed.

[0019] Once the alkali metal compounds are separated from the hydrocarbon feedstock, sulfur and metals are substantially removed, and nitrogen is moderately removed. Also, both viscosity and density are reduced (API gravity is increased). Bitumen or heavy oil would be considered synthetic crude oil (SCO) and can be shipped via pipeline for further refining. Similarly, shale oil will have been considerably upgraded after such processing. Subsequent refining will be easier since the troublesome metals have been removed.

[0020] However, for some hydrocarbon feedstocks, gravimetric separation it is not possible without further processing. For example, the inventors have observed that certain hydrocarbon feedstocks that contain a heavy fraction of hydrocarbons, upon processing with an alkali metal produce a mixture of alkali metal compounds and reduced heavy metals that could not be separated from the upgraded hydrocarbon materials through conventional gravimetric separation.

[0021] It is an object of the present invention to provide a process to facilitate separation of alkali metal compounds, such as alkali metal sulfides and nitrides, and reduced heavy metals from alkali metal reacted hydrocarbons.

~~BRIEF SUMMARY OF THE INVENTION~~

[0022] The present ~~invention~~ disclosure provides a process to facilitate separation of alkali metal compounds and reduced heavy metals from alkali metal reacted hydrocarbons.

[0022a] One aspect of the present invention relates to a process to facilitate separation of alkali metal salts from alkali metal reacted hydrocarbons comprising: heating a mixture resulting from a reaction of an alkali metal and a quantity of a hydrocarbon feedstock having at least one heavy fraction, said mixture comprising alkali metal salts and alkali metal reacted hydrocarbons, wherein the mixture is heated to a temperature in the range from about 350°C to 400°C; and mechanically mixing the mixture during the heating step.

[0022b] Another aspect relates to a process to facilitate separation of sodium sulfide from sodium-reacted hydrocarbons comprising: heating a mixture resulting from a reaction of molten sodium and a quantity of a hydrocarbon feedstock having at least one heavy fraction, said mixture comprising sodium sulfide and sodium-reacted hydrocarbons, wherein the mixture is heated to a temperature in the range from about 350°C to 400°C; mechanically mixing the mixture during the heating step; and separating gravimetrically the sodium sulfide from the sodium-reacted hydrocarbons.

[0022c] Yet another aspect relates to a process of upgrading a hydrocarbon feedstock comprising: obtaining a quantity of an oil feedstock having at least one heavy fraction, the hydrocarbon feedstock comprising at least one carbon atom and a sulfur heteroatom and/or one or more heavy metals; reacting the quantity of the hydrocarbon feedstock with an alkali metal and an upgradant hydrocarbon, wherein the upgradant hydrocarbon comprises at least one carbon atom and at least one hydrogen atom, wherein the alkali metal reacts with the sulfur heteroatom and/or the one or more heavy metals to form one or more inorganic products comprising alkali metal sulfide or alkali metal polysulfides, wherein the upgradant hydrocarbon reacts with the hydrocarbon feedstock to produce an upgraded hydrocarbon feedstock, wherein the number of carbon atoms in the upgraded hydrocarbon feedstock is greater than the number of carbon atoms in the hydrocarbon feedstock; heating the mixture of inorganic products the upgradant hydrocarbon to a temperature in the range from about 350°C to 400°C; mechanically mixing the mixture during the heating step; and separating the inorganic products from the upgraded hydrocarbon feedstock.

[0022d] Another aspect relates a process to facilitate separation of alkali metal salts from alkali metal reacted hydrocarbons comprising: adding a portion of the separated alkali metal salts to the mixture of alkali metal hydrocarbon feedstock having at least one heavy fraction, said mixture comprising alkali metal salts and alkali metal reacted hydrocarbons.

[0022e] Another aspect relates a process to facilitate removal of residual alkali metal from alkali metal reacted hydrocarbons comprising mixing a flux with the hydrocarbon to dissolve the alkali metal.

[0023] Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specification may, but do not necessarily, refer to the same embodiment, but may refer to every embodiment.

[0024] Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional