

[0016] In one aspect, embodiments disclosed herein relate to a process for reducing the sulfur content of a hydrocarbon stream. The process ~~may~~includes: contacting a full range cracked naphtha with a hydrogenation catalyst to convert at least a portion of the dienes and mercaptans to thioethers and to hydrogenate at least a portion of the dienes; fractionating the full range cracked naphtha into a light naphtha fraction, a medium naphtha fraction, and a heavy naphtha fraction; hydrodesulfurizing the heavy naphtha fraction; mixing the medium naphtha fraction with hydrogen and a gas oil to form a mixture; contacting the mixture with a hydrodesulfurization catalyst in a hydrodesulfurization reactor to produce a reactor effluent comprising hydrogen sulfide, unreacted hydrogen, and a medium naphtha fraction having a reduced sulfur concentration; and separating the medium naphtha fraction having a reduced sulfur concentration from the gas oil, the unreacted hydrogen, and hydrogen sulfide.

[0017] In another aspect, embodiments disclosed herein relate to a system for reducing the sulfur content of a hydrocarbon stream to less than about 10 ppm. The system ~~may~~includes: a hydrogenation reactor for contacting a full range cracked naphtha with a hydrogenation catalyst to convert at least a portion of the dienes and mercaptans to thioethers and to hydrogenate at least a portion of the dienes; a separation system for fractionating the full range cracked naphtha into a light naphtha fraction, a medium naphtha fraction, and a heavy naphtha fraction; a hydrodesulfurization reactor for hydrodesulfurizing the heavy naphtha fraction; a mixing device for mixing the medium naphtha fraction with hydrogen and a gas oil to form a mixture; a hydrodesulfurization reactor for contacting the mixture with a hydrodesulfurization catalyst to produce a reactor effluent comprising hydrogen sulfide, unreacted hydrogen, and a medium naphtha fraction having a reduced sulfur concentration; a separation system for separating the medium naphtha fraction having a reduced sulfur concentration from the gas oil, the unreacted hydrogen, and hydrogen sulfide.

[0018] In another aspect, embodiments disclosed herein relate to a process for a process for reducing the sulfur content of a hydrocarbon stream. The process ~~may~~includes: contacting a full range cracked naphtha with a hydrogenation catalyst to convert at least a portion of the dienes and mercaptans to thioethers and to hydrogenate at least a portion of the dienes; fractionating the full range cracked

naphtha into: a light naphtha fraction having a boiling range end point in the range from about 120°F to about 190°F and a sulfur content of less than about 15 ppm, a medium naphtha fraction having a boiling range, end point temperature minus initial boiling point temperature, of less than 150°F, and a heavy naphtha fraction having an initial boiling point in the range from about 230°F to about 270°F; hydrodesulfurizing the heavy naphtha fraction to produce a hydrodesulfurized heavy naphtha fraction has a sulfur content of less than about 12 ppm; mixing the medium naphtha fraction with hydrogen and a gas oil to form a mixture; heating the mixture; contacting the heated mixture with a hydrodesulfurization catalyst in a hydrodesulfurization reactor to produce a reactor effluent comprising hydrogen sulfide, unreacted hydrogen, and a medium naphtha fraction having a reduced sulfur concentration; separating the medium naphtha fraction having a reduced sulfur concentration from the gas oil, the unreacted hydrogen, and hydrogen sulfide to produce a medium naphtha fraction having a reduced sulfur concentration has a sulfur content of less than about 5 ppm; mixing the light naphtha fraction, the medium naphtha fraction having a reduced sulfur concentration, and the hydrodesulfurized heavy naphtha fraction to produce a full range naphtha product having a sulfur content of equal to or less than about 10 ppm.

[0019] Other ~~aspects—embodiments~~ and advantages will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0020] Figures 1 and 2 are simplified process flow diagrams illustrating prior art processes for hydrodesulfurizing a hydrocarbon feed.

[0021] Figures 3-6 are simplified process flow diagrams illustrating processes for hydrodesulfurizing a hydrocarbon feed according to embodiments disclosed herein.

DETAILED DESCRIPTION

[0022] Embodiments disclosed herein relate generally to a process for reducing the sulfur content of hydrocarbon streams. More specifically, embodiments disclosed herein relate to hydrodesulfurization processes that selectively reduce the sulfur content of FCC naphtha gasoline range feedstocks to below 10 ppm sulfur. The “selective” processes herein may reduce the sulfur content to meet the very low sulfur