Claims

1. A process for treating gasoline, comprising:

1) splitting a gasoline feedstock into a light gasoline fraction and a heavy gasoline fraction;

2) optionally, subjecting at least a portion of the resulting light gasoline fraction to etherification to obtain an etherified oil; and

3) contacting the resulting heavy gasoline fraction with a mixed catalyst and subjecting it to desulfurization and aromatization in the presence of hydrogen to obtain a heavy gasoline product;

wherein the mixed catalyst comprises an adsorption desulfurization catalyst and an aromatization catalyst, and at least 50 wt%, preferably at least 80 wt%, more preferably at least 90 wt%, particularly preferably at least 95 wt%, and most preferably 100 wt% of the aromatization catalyst has undergone a passivation and/or aging treatment, so that the aromatization catalyst has a micro-activity within a range from 20 to 55,

wherein the passivation comprises the step of contacting the aromatization catalyst with a compound containing carbon, sulfur and/or nitrogen to conduct a passivation reaction prior to the desulfurization and aromatization,

wherein the aging treatment comprises the step of treating the aromatization catalyst, prior to the desulfurization and aromatization, under the following conditions: a temperature within a range from 600 to 800 °C, an aging time within a range from 1 to 360 hours, and an aging atmosphere containing steam.

2. The process according to claim 1, further comprising the step of:

4) mixing at least a portion of the light gasoline fraction and/or at least a portion of the etherified oil with at least a portion of the heavy gasoline product to provide a gasoline product.

3. The process according to claim 1, wherein the gasoline feedstock has at least one of the following characteristics:

1) an olefin content of greater than 20% by volume;

2) a sulfur content of 10 μg/g or above; and

3) being at least one selected from the group consisting of catalytic cracking gasoline,

deep catalytic cracking gasoline, coker gasoline, thermal cracking gasoline, and straight-run gasoline, or a fraction thereof.

4. The process according to claim 1, wherein the split point between the light gasoline fraction and the heavy gasoline fraction is within a range from 60 to 80 °C.

5. The process according to claim 1, wherein the etherification comprises the step of:

contacting the light gasoline fraction with an alcohol to subject the olefin in the light gasoline fraction to an etherification reaction with the alcohol in the presence of an etherification catalyst, to obtain the etherified oil,

wherein the etherification is carried out under the following conditions: a temperature within a range from 20 to 200 °C, a pressure within a range from 0.1 to 5 MPa, a weight hourly space velocity within a range from 0.1 to 20 h^{-1}, and a molar ratio of the alcohol to the light gasoline fraction within a range of 1: (0.1-100);

and the etherification catalyst comprises at least one selected from the group consisting of resins, molecular sieves, and heteropolyacids.

6. The process according to claim 1, wherein the desulfurization and aromatization are carried out in a fluidized reactor, wherein the fluidized reactor is at least one selected from the group consisting of riser reactors and dense phase fluidized reactors.

7. The process according to claim 1, wherein the adsorption desulfurization catalyst comprises silica, alumina, zinc oxide, and a desulfurization active metal, and the desulfurization active metal is at least one selected from the group consisting of cobalt, nickel, copper, iron, manganese, molybdenum, tungsten, silver, tin and vanadium.

8. The process according to claim 7, wherein on the basis of oxides, the zinc oxide is present in an amount ranging from 10% to 90% by weight, the silica is present in an amount ranging from 5% to 85% by weight, and the alumina is present in an amount ranging from 5 to 30% by weight based on the dry weight of the adsorption desulfurization catalyst; and

on the elemental basis, the desulfurization active metal is present in the adsorption desulfurization catalyst in an amount ranging from 5% to 30% by weight based on the dry weight of the adsorption desulfurization catalyst.

9. The process according to claim 1, wherein, on dry basis, the aromatization catalyst comprises 10% to 30% by weight of a molecular sieve, 0% to 20% by weight of an

aromatization active metal oxide and 50% to 90% by weight of a support, based on the total weight of the aromatization catalyst;

wherein the molecular sieve comprises a Y molecular sieve and/or an MFI structural molecular sieve, the aromatization active metal is at least one selected from the group consisting of metal elements of Group IVB, metal elements of Group VB, metal elements of Group VIB, metal elements of Group VIII, metal elements of Group IB, metal elements of Group IIB, and metal elements of Group IIIA, and the support comprises silica and/or alumina.

10. The process according to claim 1, wherein the aromatization catalyst can be prepared from a starting material comprising 15% to 60% by weight of a natural mineral, 10% to 30% by weight of a precursor of an inorganic oxide binder, and 20% to 80% by weight of a MFI structural molecular sieve containing phosphorus and supported metal, based on the dry weight of the starting material,

wherein the MFI structural molecular sieve has a $n(SiO_2)/n(Al_2O_3)$ ratio of greater than 100; a phosphorus content, on the basis of P_2O_5, within a range from 0.1% to 5% by weight based on the dry weight of the molecular sieve; a supported-metal content, on the basis of oxides, within a range from 0.5% to 5% by weight based on the dry weight of the molecular sieve; an Al distribution parameter D(Al) satisfying $0.6 \leq D(Al) \leq 0.85$; a supported-metal distribution parameter D(M) satisfying $2 \leq D(M) \leq 10$; a mesopore volume percentage within a range from 40% to 80% relative to the total pore volume; a percentage of strong acid content relative to the total acid content within a range from 60% to 80%; and a ratio of the Bronsted acid (B acid) content to the Lewis acid (L acid) content within a range from 15 to 80.

11. The process according to claim 10, wherein the supported metal is at least one of zinc, gallium and iron.

12. The process according to claim 1, wherein the percentage of the aromatization catalyst relative to the mixed catalyst is within a range from 1% to 30% by weight.

13. The process according to claim 1, wherein the desulfurization and aromatization are carried out under the following conditions: a reaction temperature within a range from 350 to 500 °C, a weight hourly space velocity within a range from 2 to 50 h^{-1}, a reaction

pressure within a range from 0.5 MPa to 3.0 MPa, and a volume ratio of hydrogen to the heavy gasoline fraction within a range from 1 to 500.