

CLAIMS

1. Ionic liquid composition to remove sulfur from refined crude oil fraction, comprising or consisting of two or more compounds having:
- an imidazolium cation substituted by one or more straight or branched C₁-C₆ alkyl group and
 - 5 - an anion selected from the group consisting of R₅COO⁻, Cl⁻, Br⁻, [BF₄]⁻, [PF₆]⁻, [SbF₆]⁻, [R₆SO₄]⁻, [OTs]⁻, [OMs]⁻, wherein R₅ is C₁-C₆ alkyl, C₃-C₈ cycloalkyl, benzyl, C₂-C₆ alkenyl, and R₆ is C₁-C₆ alkyl.
2. The composition of claim 1, wherein the imidazolium cation is substituted in position 1 and 3
10 by a straight or branched C₁-C₆ alkyl group, optionally is substituted in position 1 by butyl and in position 3 by methyl.
3. The composition of claim 1 or claim 2, wherein the anion is selected from [BF₄]⁻ and [PF₆]⁻.
- 15 4. The composition of any one of claims 1 to 3, wherein the two or more compounds comprise
- 1-butyl-3-methyl imidazolium hexafluoro phosphate, and
 - 1-butyl-3-methyl imidazolium tetrafluoroborate.
5. The composition of claim 1 or 2, wherein the anion is selected from Cl⁻, [BF₄]⁻ and [PF₆]⁻.
- 20 6. The composition of any of claims 1 to 5, comprising or consisting of:
- 1-butyl-3-methyl imidazolium hexafluoro phosphate,
 - 1-butyl-3-methyl imidazolium tetrafluoroborate, and
 - 1-butyl-3-methyl imidazolium chloride.
- 25 7. The composition of claim 6, comprising or consisting of:
- from 30 to 50 % by volume of 1-butyl-3-methyl imidazolium hexafluoro phosphate,
 - from 20 to 30 % by volume of 1-butyl-3-methyl imidazolium tetrafluoroborate,
 - from 25 to 35 % by volume of 1-butyl-3-methyl imidazolium chloride,
- 30 with respect to the total volume of the composition.
8. The composition of claim 7, comprising or consisting of:
- from 35 to 44 % by volume of 1-butyl-3-methyl imidazolium hexafluoro phosphate,
 - from 22 to 27 % by volume of 1-butyl-3-methyl imidazolium tetrafluoroborate,

- from 26 to 29 % by volume of 1-butyl-3-methyl imidazolium chloride,
with respect to the total volume of the composition.

5 9. The composition of any one of claims 6 to 8, wherein the volume ratio between 1-butyl-3-methyl imidazolium hexafluoro phosphate, 1-butyl-3-methyl imidazolium tetrafluoroborate and 1-butyl-3-methyl imidazolium chloride is comprised between 1:0.63:0.74 and 1:0.61:0.66.

10 10. The composition of any one of claims 1 to 9, wherein the composition (i) does not comprise an oxidizing agent; and/or (ii) does not comprise a metal salt.

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11. The composition of any one of claims 1 to 10, additionally comprising water and/or an organic solvent.

12. A process for desulfurization of a refined crude oil fraction, comprising:
15 - mixing a ionic liquid composition according to any of claims 1 to 11 with a batch of refined crude oil fraction in a mixing tank (2) to manufacture an emulsion comprising at least the refined crude oil fraction and the ionic liquid composition;
- feeding the emulsion through a catalytic reactor (9) to bind at least S-compounds, and optionally other metals, of the refined crude oil fraction to the ionic liquid composition;
20 - feeding the emulsion into a settling tank (6) and storing the emulsion in said settling tank (6) for a settling time (t) in order to leave the S-compounds bond to the ionic liquid composition to separate by gravity from a desulfurized refined crude oil fraction and to settle down in the settling tank (6).

wherein, optionally, the desulfurized refined crude oil fraction is then transferred to a storage or
25 service tank (7); wherein, optionally, the settled ionic liquid composition containing S-compounds is then transferred to a flashing unit (12).

13. The process of claim 12, wherein, before mixing the ionic liquid composition with the batch of refined crude oil fraction, the ionic liquid composition is mixed with demineralized water and then the
30 mixture of ionic liquid composition and demineralized water is fed to the mixing tank (6) containing or configured to contain the batch of refined crude oil fraction.

14. The process of any of claims 12 or 13, wherein, in the flashing unit (12), S-compounds are separated from the ionic liquid composition and form a residual sludge in the flashing unit (12);

wherein the ionic liquid composition free of S-compounds is fed to a separate re-use tank (4') to be reused in the process; wherein the residual sludge is transferred to a holding tank (13) and, optionally, dried and packed for further handling.

- 5 15. An apparatus for desulfurization of a refined crude oil fraction configured to perform the process of any of claims 12 to 14, wherein the apparatus comprises:
- a mixing tank (2) having a first inlet in fluid communication with a tank (3) of refined crude oil fraction; a fresh ionic liquid composition tank (4) and/or a re-use ionic liquid composition tank (4') in fluid communication with a second inlet of the mixing tank (2);
- 10 at least one settling tank (6) having an inlet (6a) in fluid communication with an outlet (2c) of the mixing tank (2); wherein said at least one settling tank (6) has a first upper outlet (6b) for delivering desulfurized refined crude oil fraction and a second lower outlet (6c) for delivering settled ionic liquid composition containing S-compounds;
- a catalytic reactor (9) located between the outlet of the mixing tank (2) and the inlet (6a) of said at
- 15 least one settling tank (6).