SUMMARY

It has been found by the present inventor(s) that arsenic may be effectively removed after a liquid oil feed has been through a stabilization process step which provides a stabilized liquid oil feed and before a process step comprising catalytic hydroprocessing. The arsenic is captured using a guard material. In this way, removal of arsenic may take place between the initial stabilization and the catalyst hydroprocessing. For processing renewable feedstocks with a high content of arsenic it is surprisingly not necessary to remove the arsenic prior to the hydrotreating process as for the conventional process. Some conversion of organically bound arsenic may occur in the stabilization reactor, which is why the stabilization reactor may beneficially have a top layer suited for capture of solid heteratom products, e.g. by having an open structure.

There is provided a process for removal of arsenic in the processing of renewable feedstocks. Said process comprises using a system comprising:

- a liquid oil feed derived from a renewable feedstock;
- a stabilization reactor;
- a guard material;
- at least a first hydroprocessing reactor;

wherein said process comprises the steps of:

- feeding the liquid oil feed to said stabilization reactor and providing a stabilized liquid oil feed;
- feeding at least a portion of the stabilized liquid oil feed to said guard material, and capturing the arsenic in the guard material, so to provide an arsenic-poor liquid oil feed,
- feeding said arsenic-poor liquid oil feed to said hydroprocessing reactor, and subjecting it to catalytic hydroprocessing, to provide one or more hydroprocessed product stream(s).

In one aspect of the present disclosure, there is provided a process for removal of arsenic in the processing of renewable feedstocks using a system comprising:

- a liquid oil feed derived from a renewable feedstock;
- a stabilization reactor;
- a guard material;

- at least a first hydroprocessing reactor;

wherein said process comprises the steps of:

- feeding the liquid oil feed to said stabilization reactor to contact a stabilization hydrotreatment catalyst and providing a stabilized liquid oil feed;
- feeding at least a portion of the stabilized liquid oil feed to said guard material, and capturing the arsenic in the guard material, so to provide an arsenic-poor liquid oil feed,
- feeding said arsenic-poor liquid oil feed to said hydroprocessing reactor, and subjecting it to catalytic hydroprocessing, to provide one or more hydroprocessed product stream(s),
- wherein said stabilization hydrotreatment catalyst comprises less than 10 wt% Ni, such as less than 8 wt% Ni, less than 5 wt% Ni or in which Ni is absent,
- and wherein said guard material comprises more than 10 wt% Ni, such as more than 12 wt% Ni.

Additional examples of the disclosure are presented in the following description text, figures and claims.

LEGENDS TO THE FIGURE

The technology is illustrated by means of the following schematic illustrations, in which:

Claims

1. A process for removal of arsenic in the processing of renewable feedstocks using a system comprising:

- a liquid oil feed derived from a renewable feedstock;
- a stabilization reactor;
- a guard material;
- at least a first hydroprocessing reactor;

wherein said process comprises the steps of:

- feeding the liquid oil feed to said stabilization reactor to contact a stabilization hydrotreatment catalyst and providing a stabilized liquid oil feed;
- feeding at least a portion of the stabilized liquid oil feed to said guard material, and capturing the arsenic in the guard material, so to provide an arsenic-poor liquid oil feed,
- feeding said arsenic-poor liquid oil feed to said hydroprocessing reactor, and subjecting it to catalytic hydroprocessing, to provide one or more hydroprocessed product stream(s),
- wherein said stabilization hydrotreatment catalyst comprises less than 10 wt% Ni, such as less than 8 wt% Ni, less than 5 wt% Ni or in which Ni is absent,
- and wherein said guard material comprises more than 10 wt% Ni, such as more than 12 wt% Ni.

2. The process according to claim 1, wherein the renewable feedstock contains :
- a lignocellulosic biomass such as wood products, algae, grass, forestry waste and/or agricultural residue;
- municipal waste, in particular the organic portion thereof,
- nitrogen-rich renewable feedstock such as manure or sewage sludge.

3. The process according to any one of the preceding claims, wherein said process further comprises a step of thermal decomposition of the renewable feedstock to produce said liquid oil feed where said thermal decomposition comprises a pyrolysis step and/or a hydrothermal liquefaction step.

4. The process according to any one of the preceding claims, wherein the liquid oil feed comprises at least 1 wt % oxygen (O), such as at least 20 wt% O, such as at least 30 wt% O, or at least 45 wt% O.

5. The process according to any one of the preceding claims, wherein said process comprises operating the stabilization reactor at a temperature of 100-230°C and at a pressure of 20-200 barg.

6. The process according to any one of the preceding claims, wherein said process comprises reacting said liquid oil feed with hydrogen within the stabilization reactor in the presence of a stabilization hydrotreatment catalyst where said catalyst comprises at least one metal selected from Ni, Co, Mo, W, Cu, Pt, Pd, Ru such as said catalyst comprises nickel-molybdenum molybdenum (Ni-Mo), cobalt-molybdenum (Co-Mo), nickel-tungsten (NiW), nickel-copper (NiCu), Pt, Pd, or Ru to provide at least one stabilized liquid oil feed.

7. The process according to any one of the preceding claims, wherein the stabilization reactor additionally comprises a top layer suited for capture of solid heteratom products, e.g. by having an open structure.

8. The process according to any one of the preceding claims, wherein said guard material is arranged in units and wherein said process comprises using one or more guard material units.

9. The process according to claim 7, wherein said process comprises using two or more guard material units arranged in parallel.

10. The process according to claim 7, wherein said process comprises using two or more guard material units arranged in series.

11. The process according to any one of the preceding claims, wherein at least a portion of said guard material is located within said first catalytic hydroprocessing reactor, upstream the hydroprocessing catalyst.

12. The process according to any one of the preceding claims, wherein said process comprises capturing the arsenic in the guard material where said guard material is a metal guard bed such Ni/Al_2O_3.

13. The process according to any one of the preceding claims, wherein said process comprises operating the guard material at a temperature above 250°C, such as at 250-420°C.

14. The process according to any one of the preceding claims, wherein said process comprises capturing one or more additional heteroatom(s) in the guard material where said

heteroatom(s) is/are selected from one or more of phosphorus (P), silicon (Si), iron (Fe), nickel (Ni), vanadium (V), halides or combinations thereof.

15. The process according to any one of the preceding claims, wherein said one or more catalytic hydroprocessing steps are selected from hydrodeoxygenation (HDO), hydrotreating, hydrodenitrogenation (HDN), hydrodesulfurization (HDS), saturation of aromatic rings (HDA) hydrocracking and/or isomerisation.