CLAIMS

1. A process for upgrading a petroleum-based composition while decreasing plugging comprising:

mixing a supercritical water stream with a pressurized, heated petroleum-based composition in a mixing device to create a combined feed stream;

introducing the combined feed stream to an upgrading reactor system to produce an upgraded product, where the upgrading reactor system operates at a temperature greater than a critical temperature of water and a pressure greater than a critical pressure of water, and where the upgrading reactor system comprises one or more upgrading reactors;

passing the upgraded product out of the upgrading reactor system;

cooling the upgraded product with a cooling device to create a cooled upgraded product having a temperature less than 200°C;

decreasing the pressure of the cooled upgraded product with a pressure reducer to create a cooled, depressurized stream having a pressure from 0.05 megapascals (MPa) to 2.2 MPa; and

injecting plug remover solution into one or more injection locations at a temperature within 200°C of a temperature of an internal fluid at the injection locations and a pressure of 100% to 120% of the pressure of the internal fluid at the injection location, where the plug remover solution comprises an aromatic solvent and less than 500 parts per million (ppm) of water, and where the injection locations include one or more of:

an injection port on a process line connecting the mixing device with the upgrading reactor system;

an injection port on a process line connecting the upgrading reactor system with the cooling device; or

an injection port on a process line connecting the cooling device with the pressure reducer.

2. The process of claim 1, where plug remover solution is injected into at least two of the injection locations.

3. The process of claim 1, where the supercritical water stream is produced by feeding water to a first pump and a first heating device downstream of the first pump, and the pressurized, heated petroleum-based composition is produced by feeding the petroleum-based composition to a second pump and a second heating device downstream of the second pump, where the pressurized, heated petroleum-based composition is at a temperature greater than 50°C.

4. The process of claim 3, further comprising injecting plug remover solution at one or more of the following injection locations:

at least one injection port on a process line connecting the first pump with the first heating device;

at least one injection port on a process line connecting the second pump with the second heating device;

at least one injection port on a process line connecting the first heating device with the mixing device; or

at least one injection port on a process line connecting the second heating device with the mixing device.

5. The process of claim 1, where the plug remover solution is injected into one or more of the injection locations if there is a detected pressure gradient above a threshold level.

6. The process of claim 5, where the threshold level is a pressure drop of at least 1% in one or more sections of

the process line connecting the mixing device with the upgrading reactor system;

the process line connecting the upgrading reactor system with the cooling device;

the process line connecting the cooling device with the pressure reducer; or

combinations thereof.

7. The process of claim 1, where the process lines include multiple injection ports.

8. The process of claim 1, where the plug remover solution is injected in stepwise fashion, such that a flow rate of the plug remover solution is gradually increased.

9. The process of claim 1, where plug remover solution is injected at injection locations upstream and downstream of a pressure gradient on one or more sections of

the process line connecting the mixing device with the upgrading reactor system;
the process line connecting the upgrading reactor system with the cooling device;
the process line connecting the cooling device with the pressure reducer; or
combinations thereof.

10. The process of claim 1, further comprising injecting plug remover solution into an injection port on a process line connecting a first reactor and a second reactor downstream of the first reactor.

11. The process of claim 1, where the plug remover solution is injected when there is a pressure gradient between the upgrading reactor system and the cooling device.

12. The process of claim 1, further comprising one or more pressure measuring devices.

13. The process of claim 1, where the upgrading reactor system includes a first reactor and a second reactor downstream of the first reactor.

14. The process of claim 13, where the first reactor has dimensions defined by the equation L/D, where L is the length of the first reactor and D is the diameter of the first reactor, where the L/D is sufficient to achieve superficial velocity of fluid greater than 0.5 meter/min.

15. A process of claim 1, where the one or more injection locations are one or more injection ports positioned from 10 to 90% of the length of the one or more process lines.

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