CLAIMS

1. A process for removal of contaminants from a crude oil stream, the process comprising the steps of:

   feeding a crude oil stream to a mixing apparatus;

   feeding a supercritical water stream to the mixing apparatus;

   mixing the crude oil stream and the supercritical water stream in the mixing apparatus to produce a mixed crude oil and supercritical water stream;

   feeding the mixed crude oil and supercritical water stream to a physical filter to remove solid compounds from the mixed crude oil and supercritical water stream and to produce a filtered mixed crude oil and supercritical water stream;

   feeding the filtered mixed crude oil and supercritical water stream to a unit for further processing.

2. The process of claim 1 wherein the unit is a desulfurization unit.

3. The process of either claim 1 or claim 2 wherein the solid compounds are precipitated as a result of the crude oil stream and supercritical water stream mixing in the mixing apparatus.

4. The process of claim 3 wherein the solid compounds are alkaline compounds.

5. The process of any of claims 1 to 4 further comprising the step of:

   feeding the supercritical water stream to a water filter to produce a filtered supercritical water stream before feeding the supercritical water stream to the mixing apparatus.

6. The process of any of claims 1 to 5 wherein the physical filter comprises two or more filters arranged in series.

7. The process of any of claims 1 to 5 wherein the physical filter comprises two or more physical filters arranged in parallel.

8. The process of any of claims 1 to 7 wherein the temperature of the mixed crude oil and supercritical water stream as it is fed to the physical filter is maintained at a temperature of over 400°C.

15. The process of any of claims 12 to 14 wherein the temperature of the mixed crude oil and supercritical water stream as it is fed to the physical filter is maintained at a temperature of over 400°C.

16. The process of any of claims 12 to 15 wherein the physical filter is a cup-type filter, a membrane-type filter, or a depth-type filter.

17. The process of any of claims 12 to 16 wherein the solid compounds are alkaline compounds in the water stream.

18. The process of any of claims 12 to 17 wherein the second solid compounds are alkaline compounds that precipitate as a result of the crude oil stream mixing with the supercritical water stream in the mixing apparatus.

19. The process of any of claims 12 to 18 further comprising the step of:

feeding the mixed crude oil and supercritical water stream to an apparatus for creating turbulent flow of the mixed crude oil and supercritical water stream to produce a turbulent flow mixed crude oil and supercritical water stream before feeding the mixed crude oil and supercritical water stream to the filter.

20. The process of claim 17 wherein the apparatus for creating turbulent flow is a continuous stirred tank reactor.

21. A process for removal of contaminants from a crude oil stream, the process comprising the steps of:

feeding a water stream to a water filter to remove solid alkaline compounds to produce a filtered water stream;

heating the filtered water stream to supercritical conditions using a heating apparatus to produce a filtered supercritical water stream, the filtered supercritical water stream being maintained at a temperature of over 400°C;

feeding the filtered supercritical water stream to a mixing apparatus, the filtered supercritical water stream being maintained at a temperature of over 400°C;

feeding a crude oil stream to the mixing apparatus;

mixing the crude oil stream and the filtered supercritical water stream in the mixing apparatus to produce a mixed crude oil and supercritical water stream;

CLAIMS

1. A process for removal of contaminants from a crude oil stream, the process comprising the steps of:

feeding a crude oil stream to a mixing apparatus;

feeding a supercritical water stream to the mixing apparatus;

mixing the crude oil stream and the supercritical water stream in the mixing apparatus to produce a mixed crude oil and supercritical water stream;

feeding the mixed crude oil and supercritical water stream to a physical filter to remove solid compounds from the mixed crude oil and supercritical water stream and to produce a filtered mixed crude oil and supercritical water stream;

feeding the filtered mixed crude oil and supercritical water stream to a unit for further processing.

2. The process of claim 1 wherein the unit is a desulfurization unit.

3. The process of either claim 1 or claim 2 wherein the solid compounds are precipitated as a result of the crude oil stream and supercritical water stream mixing in the mixing apparatus.

4. The process of claim 3 wherein the solid compounds are alkaline compounds.

5. The process of any of claims 1 to 4 further comprising the step of:

feeding the supercritical water stream to a water filter to produce a filtered supercritical water stream before feeding the supercritical water stream to the mixing apparatus.

6. The process of any of claims 1 to 5 wherein the physical filter comprises two or more filters arranged in series.

7. The process of any of claims 1 to 5 wherein the physical filter comprises two or more physical filters arranged in parallel.

8. The process of any of claims 1 to 7 wherein the temperature of the mixed crude oil and supercritical water stream as it is fed to the physical filter is maintained at a temperature of over 400°C.

9. The process any of claims 1 to 8 wherein the physical filter is a cup-type filter, a membrane-type filter, or a depth-type filter.

10. The process of any of claims 1 to 9 further comprising the step of:

feeding the mixed crude oil and supercritical water stream to an apparatus for creating turbulent flow of the mixed crude oil and supercritical water stream to produce a turbulent flow mixed crude oil and supercritical water stream before feeding the mixed crude oil and supercritical water stream to the filter.

11. The process of claim 10 wherein the apparatus for creating turbulent flow is a continuous stirred tank reactor.

12. A process for removal of contaminants from a crude oil stream, the process comprising the steps of:

feeding a water stream below supercritical conditions to a water filter to remove solid compounds to produce a filtered water stream;

heating the filtered water stream to supercritical conditions using a heating apparatus to produce a filtered supercritical water stream;

feeding the filtered supercritical water stream to a mixing apparatus;

feeding a crude oil stream to the mixing apparatus;

mixing the crude oil stream and the filtered supercritical water stream in the mixing apparatus to produce a mixed crude oil and supercritical water stream;

feeding the mixed crude oil and supercritical water stream to a physical filter to remove second solid compounds from the mixed crude oil and supercritical water stream and to produce a filtered mixed crude oil and supercritical water stream;

feeding the filtered mixed crude oil and supercritical water stream to a unit for further processing.

13. The process of claim 12 wherein the physical filter comprises two or more filters arranged in series.

14. The process of claim 12 wherein the physical filter comprises two or more filters arranged in parallel.

15. The process of any of claims 12 to 14 wherein the temperature of the mixed crude oil and supercritical water stream as it is fed to the physical filter is maintained at a temperature of over 400°C.

16. The process of any of claims 12 to 15 wherein the physical filter is a cup-type filter, a membrane-type filter, or a depth-type filter.

17. The process of any of claims 12 to 16 wherein the solid compounds are alkaline compounds in the water stream.

18. The process of any of claims 12 to 17 wherein the second solid compounds are alkaline compounds that precipitate as a result of the crude oil stream mixing with the supercritical water stream in the mixing apparatus.

19. The process of any of claims 12 to 18 further comprising the step of:

feeding the mixed crude oil and supercritical water stream to an apparatus for creating turbulent flow of the mixed crude oil and supercritical water stream to produce a turbulent flow mixed crude oil and supercritical water stream before feeding the mixed crude oil and supercritical water stream to the filter.

20. The process of claim 19 wherein the apparatus for creating turbulent flow is a continuous stirred tank reactor.

21. A process for removal of contaminants from a crude oil stream, the process comprising the steps of:

feeding a water stream to a water filter to remove solid alkaline compounds to produce a filtered water stream;

heating the filtered water stream to supercritical conditions using a heating apparatus to produce a filtered supercritical water stream, the filtered supercritical water stream being maintained at a temperature of over 400°C;

feeding the filtered supercritical water stream to a mixing apparatus, the filtered supercritical water stream being maintained at a temperature of over 400°C;

feeding a crude oil stream to the mixing apparatus;

mixing the crude oil stream and the filtered supercritical water stream in the mixing apparatus to produce a mixed crude oil and supercritical water stream;

feeding the mixed crude oil and supercritical water stream to a continuous stirred tank reactor to produce a turbulent flow mixed crude oil and supercritical water stream;

feeding the turbulent flow mixed crude oil and supercritical water stream, the turbulent flow mixed crude oil and supercritical water stream being maintained at a temperature of over 400°C, to a physical filter to remove second solid compounds from the mixed crude oil and supercritical water stream to produce a filtered mixed crude oil and supercritical water stream;

feeding the filtered mixed crude oil and supercritical water stream to a unit for further processing.