CLAIMS

1. A method of processing crude oil comprising:

adding water to the crude oil to produce oil and brine and a rag layer including an emulsion comprising brine and oil and solids;

separating oil from brine comprising the rag layer;

separating the rag layer into a hydrocarbon emulsion having finer solids and brine comprising larger solids, wherein the larger solids have a size of about 40 microns or more and the finer solids have a size of less than about 40 microns; and

passing the hydrocarbon emulsion and finer solids along a cross-flow filter to produce a retentate comprising brine and solids and a permeate comprising hydrocarbon.

2. The method according to claim 1, further comprising separating brine from the brine comprising the rag layer.

3. The method according to claim 1 or 2, further comprising adding one or more of additional hydrocarbon, a demulsifier, a reverse demulsifier, a coagulant, and a flocculant to the rag layer.

4. A method of processing crude oil comprising:

passing the crude oil through a desalter, including separating oil from brine comprising a rag layer and removing the brine comprising a rag layer from the desalter via a first port and removing the oil via a second port;

passing the brine comprising the rag layer through a separator including separating the rag layer into a hydrocarbon emulsion having finer solids and brine comprising larger solids, including removing the brine comprising larger solids from the separator via a third port and removing the hydrocarbon emulsion and finer solids from the separator via a fourth port, wherein the larger solids have a size of about 40 microns or more and the finer solids have a size of less than about 40 microns; and

filtering the hydrocarbon emulsion and finer solids using a cross-flow filter to produce a retentate comprising brine and solids and a permeate comprising hydrocarbon, including removing the retentate from the cross-flow filter via a fifth port and removing the permeate from the cross-flow filter via a sixth port.

5. The method according to claim 4, further comprising adding one or more of additional hydrocarbon, a demulsifier, a reverse demulsifier, a coagulant, and a flocculant to the rag layer.

6. The method according to claim 5, further comprising mixing the rag layer and the one or more of the additional hydrocarbon, the demulsifier, the reverse demulsifier, the coagulant, and the flocculant in a mixer.

7. The method according to any one of claims 3, 5 or 6, comprising heating the additional hydrocarbon to a temperature of about 66°C (150 °F) to about 149°C (300 °F) and adding the heated additional hydrocarbon to the rag layer.

8. The method according to any one of claims 1-7, further comprising recirculating the retentate to the cross-flow filter.

9. The method according to claim 8, further comprising directing the hydrocarbon emulsion and finer solids from the separator to a working tank and recirculating the hydrocarbon emulsion to the cross-flow filter via the working tank.

10. The method according to any one of claims 1-9, further comprising increasing one or both of the pressure and flow rate of the hydrocarbon emulsion and finer solids by directing the hydrocarbon emulsion and finer solids through a pump.

11. A system for processing crude oil, the system comprising:

a desalter that separates oil from brine comprising a rag layer;

at least one port directing crude oil and/or water into the desalter;

at least one port directing the oil from the desalter;

at least one port directing the brine comprising the rag layer from the desalter;

a separator that separates the rag layer into a hydrocarbon emulsion having finer solids and brine comprising larger solids;

at least one port directing the rag layer into the separator;

at least one port directing the hydrocarbon emulsion and finer solids from the separator;

at least one port directing the brine and larger solids from the separator;

a housing including a cross-flow filter that separates the hydrocarbon emulsion into a permeate comprising hydrocarbon and a retenate comprising brine and solids;
at least one port directing the hydrocarbon emulsion and finer solids into the housing;

at least one port directing permeate from the housing; and
at least one port directing retentate from the housing.

12. The system according to claim 11, further comprising a bulk separator that separates brine from the brine comprising the rag layer, at least one port directing the rag layer from the desalter to the bulk separator, and at least one port directing brine from the bulk separator.

13. The system according to claim 11 or 12, further comprising at least one port directing one or more of additional hydrocarbon, a demulsifier, a reverse demulsifier, a coagulant, and a flocculant into the rag layer.

14. The system according to claim 13, further comprising a mixer mixing the one or more of the additional hydrocarbon, the demulsifier, the reverse demulsifier, the coagulant, and the flocculant in the rag layer.

15. The system according to claim 13 or 14, comprising at least one port directing the additional hydrocarbon into the rag layer, wherein the additional hydrocarbon is heated to a temperature of about 66°C (150 °F) to about 149°C (300 °F).

16. The system according to any one of claims 11-15, further comprising a working tank, at least one port directing the hydrocarbon emulsion to the working tank, at least one port directing the hydrocarbon emulsion from the working tank to the housing, and at least one port directing retentate from the housing to the working tank.

17. The system according to claim 16, further comprising a pump that increases one or both of the pressure and flow rate of the hydrocarbon emulsion, wherein the pump fluidly communicates between the interior of the working tank and the interior of the housing including the cross-flow filter.