CLAIMS

1. A method for treating an aqueous feed stream comprising hydrocarbons, the method comprising:

pre-treating a plurality of media composite particles with an aqueous liquid to produce a plurality of pre-treated media composite particles, each pre-treated media composite particle comprising a mixture of a cellulose-based material and a polymer;

introducing the feed stream to an inlet of a vessel containing the plurality of pre-treated media composite particles; and

contacting the feed stream with the plurality of pre-treated media composite particles to load an amount of the hydrocarbons from the feed stream on the pre-treated media composite particles and to produce a treated stream, the treated stream having a target concentration of hydrocarbons less than a concentration of hydrocarbons in the feed stream.

2. The method of claim 1, wherein the target concentration of hydrocarbons in the treated stream is less than about 30 ppm.

3. The method of claim 1, wherein contacting the feed stream with the plurality of pre-treated media composite particles comprises coalescing emulsified hydrocarbons in the feed stream via the plurality of pre-treated media composite particles, wherein the target concentration of hydrocarbons in the treated stream is a reduced concentration of emulsified hydrocarbons relative to the feed stream.

4. The method of claim 3, wherein the reduced concentration of emulsified hydrocarbons in the treated stream is reduced relative to the feed stream by greater than about 50%.

5. The method of claim 1, further comprising:

measuring at least one of a concentration of hydrocarbons in the treated stream and a flow rate of the treated stream;

backwashing the plurality of pre-treated media composite particles based on at least one of the measured concentration of hydrocarbons in the treated stream and the measured flow rate of the treated stream to produce a hydrocarbon liquid effluent; and

recycling the hydrocarbon liquid effluent to the feed stream.

6. The method of claim 1, wherein pre-treating the plurality of media composite particles comprises contacting each media composite particle with the aqueous liquid for a predetermined time interval.

7. A method for treating an aqueous feed stream comprising hydrocarbons, the method comprising:

pre-treating a plurality of media composite particles with an aqueous liquid to produce pre-treated media composite particles, each pre-treated media composite particle comprising a mixture of a cellulose-based material and a polymer;

passing the feed stream at a first flux rate through a coalescer containing a plurality of the pre-treated media composite particles to coalesce emulsified hydrocarbons in the feed stream thereon and produce a coalesced stream comprising coalesced hydrocarbons; and

passing the coalesced stream at a second flux rate through a filter device in communication with the coalescer to remove at least a portion of the coalesced hydrocarbons from the coalesced stream and produce an effluent stream, the filter device containing a plurality of the pre-treated media composite particles.

8. The method of claim 7, wherein the first flux rate is in a range of from about 100 to about 200 gpm/ft^2 (from about 4074 litre/min/m^2 to about 8150 litre/min/m^2).

9. The method of claim 7, wherein the second flux rate is less than about 15 gpm/ft^2 (611 litre/min/m^2).

10. The method of claim 7, further comprising maintaining a concentration of hydrocarbons in the effluent stream at a predetermined target percent reduction.

11. The method of claim 7, further comprising backwashing at least one of the coalescer and the filter device.

12. The method of claim 11, wherein backwashing the at least one of the coalescer and the filter device is based on a predetermined time interval.

13. The method of claim 11, further comprising measuring a flow rate of the coalesced stream and backwashing the coalescer based on the measured flow rate of the coalesced stream to produce a hydrocarbon liquid effluent.

14. The method of claim 11, further comprising measuring at least one of a flow rate of the effluent stream and a concentration of hydrocarbons in the effluent stream and backwashing the filter device based on at least one of the measured flow rate of the effluent stream and a measured concentration of hydrocarbons in the effluent stream to produce a hydrocarbon liquid effluent.

15. The method of claim 7, wherein pre-treating the plurality of media composite particles comprises contacting each media composite particle with the aqueous liquid for a predetermined time interval.

16. A system for treating an aqueous feed stream comprising hydrocarbons, the system comprising:

at least one pre-treatment device in communication with the feed stream and a source of an aqueous liquid, the at least one pre-treatment device containing a plurality of media composite particles, each pre-treated media composite particle pre-treated with the aqueous liquid and comprising a mixture of a cellulose-based material and a polymer;

at least one coalescer in communication with the feed stream and containing a plurality of the pre-treated media composite particles, the at least one coalescer configured to reduce an amount of emulsified hydrocarbons in the feed stream and generate a coalesced stream comprising coalesced hydrocarbons; and

at least one separator device in fluid communication with the coalescer configured to separate the coalesced hydrocarbons from an aqueous portion of the coalesced stream to generate a treated stream comprising a reduced amount of hydrocarbons relative to the feed stream.

17. The system of claim 16, wherein the separator device is at least one of a filter device, a hydrocyclone, a gravity settling device, and a flotation device.

18. The system of claim 17, wherein the separator device is a filter device containing a plurality of the pre-treated media composite particles.

19. The system of claim 16, wherein each media composite particle comprises a concentration of cellulose-based material of at least about 45% by weight.

20. The system of claim 16, wherein the cellulose-based material comprises a wood material.

21. The system of claim 16, wherein each media composite particle has a size distribution in a range of from about 5 mesh to about 10 mesh.