CLAIMS

1. A system for treating a feed stream comprising hydrocarbons and an aqueous-based liquid, comprising:

a vessel comprising a feed stream inlet fluidly connectable to the feed stream and a treated stream outlet in communication with a treated stream;

a first layer of filter media positioned within the vessel;

a second layer of filter media positioned within the vessel;

a draft tube located within the vessel and positioned within the first layer of filter media and the second layer of filter media;

a gas inlet in communication with the draft tube;

a source of gas in communication with the gas inlet;

a backwash fluid inlet fluidly connectable to a source of backwash fluid and at least one of the first layer of filter media and the second layer of filter media; and

a contaminant outlet.

2. The system of claim 1, wherein the first layer of filter media and the second layer of filter media are positioned within the vessel between the feed stream inlet and the treated stream outlet.

3. The system of claim 1, wherein the second layer of filter media is positioned below the first layer of filter media.

4. The system of claim 3, wherein the first layer of filter media has a specific gravity with a value that is less than a value of a specific gravity of the second layer of filter media.

5. The system of claim 1, wherein the backwash fluid inlet is positioned below the second layer of filter media.

6. The system of claim 1, wherein the contaminant outlet is positioned below the feed inlet.

7. The system of claim 1, wherein the first layer of filter media comprises a plurality of composite media pellets, each pellet of composite media comprising a mixture of a cellulose-based material and a polymer.

8. The system of claim 7, wherein each composite media pellet has a size in a range of from about 5 to about 30 mesh.

9. The system of claim 7, wherein the first layer of filter media and the second layer of filter media comprise composite media pellets.

10. The system of claim 1, wherein the second layer of filter media comprises walnut shells.

11. The system of claim 10, wherein the walnut shells have a size in a range of from about 12 to about 16 mesh.

12. The system of claim 1, wherein a volume of the first layer of filter media is at least about twice a volume of the second layer of filter media.

13. The system of claim 1, wherein the gas inlet is positioned within the draft tube.

14. The system of claim 1, wherein the treated stream has a hydrocarbon concentration of less than about 5 mg/L.

15. A method for treating a feed stream comprising hydrocarbons and an aqueous-based liquid, comprising:

introducing the feed stream to a vessel containing a first layer of filter media and a second layer of filter media, at least one of the first layer of filter media and the second layer of filter media comprising a plurality of composite media pellets, each composite media pellet comprising a mixture of cellulose-based material and a polymer; and

contacting the feed stream with the first layer of filter media and the second layer of filter media to produce a treated stream having a concentration of hydrocarbons that is less than a concentration of hydrocarbons in the feed stream.

16. The method of claim 15, wherein the second layer of filter media is positioned below the first layer of filter media.

17. The method of claim 16, wherein the first layer of filter media has a specific gravity with a value that is less than a value of a specific gravity of the second layer of filter media.

18. The method of claim 15, wherein contacting the feed stream with the first layer of filter media and the second layer of filter media produces a treated stream with a hydrocarbon concentration of less than about 5 mg/L.

19. The method of claim 15, wherein the feed stream further comprises suspended solids.

20. The method of claim 19, wherein contacting the feed stream with the first layer of filter media and the second layer of filter media produces a treated stream having a concentration of suspended solids that is less than a concentration of suspended solids in the feed stream.

21. The method of claim 19, further comprising:

passing a gas through a draft tube in a direction counter a flow of the feed stream, the draft tube located within the vessel and positioned within the first layer of filter media and the second layer of filter media and forming a peripheral zone positioned between a sidewall of the draft tube and a sidewall of the vessel;

passing a backwash fluid through the first and second layers of filter media and the peripheral zone in a direction counter the flow of the feed stream; and

removing at least a portion of the hydrocarbons and suspended solids from the vessel.

22. The method of claim 21, further comprising:

measuring at least one property of the vessel to provide a measured property; and

passing at least one of the gas and the backwash fluid based on the measured property.

23. The method of claim 15, wherein the first layer of filter media comprises a plurality of composite media pellets, and the second layer of filter media comprises walnut shells.

24. The method of claim 15, wherein the first and second layers of filter media comprise a plurality of composite media pellets.

25. The method of claim 15, wherein contacting the feed stream with the first layer of filter media and the second layer of filter media comprises coalescing and filtering the feed stream.

26. The method of claim 25, wherein contacting the feed stream with the first layer of filter media comprises coalescing the feed stream.

27. The method of claim 25, wherein contacting the feed stream with the second layer of filter media comprises filtering the feed stream.

CLAIMS

1. A system for treating a feed stream comprising hydrocarbons and an aqueous-based liquid, the system comprising:

a vessel comprising a feed stream inlet fluidly connected with the feed stream and a treated stream outlet fluidly connected with a treated stream; and

a filter bed positioned within the vessel and comprising a first layer of filter media disposed on a second layer of filter media,

wherein at least the first layer comprises a plurality of composite media particles, each of the plurality of composite media particles comprising a mixture of a cellulose-based material and a polymer, and

wherein the filter media of the second layer has a distinct characteristic relative to the filter media of the first layer, the characteristic selected from the group consisting of a type of material, specific gravity, density, and particle size.

2. The system of claim 1, wherein the characteristic comprises specific gravity, and wherein the first layer comprises a lower specific gravity than that of the second layer.

3. The system of claim 1, wherein the characteristic comprises density, and wherein the first layer comprises a lower density than that of the second layer.

4. The system of claim 1, wherein the second layer comprises a plurality of composite media particles, each of the plurality of composite media particles of the second layer also comprising a mixture of a cellulose-based material and a polymer, wherein the characteristic comprises particle size, and wherein the composite media particles of the first layer comprise a larger particle size than the composite media particles of the second layer.

5. The system of claim 1, wherein the second layer of filter media comprises walnut shells.

6. The system of claim 1, wherein the second layer comprises a plurality of composite media particles, each of the plurality of composite media particles of the second layer also comprising a mixture of a cellulose-based material and a polymer, and wherein the second layer further comprises an additive effective to provide the second layer with a greater specific gravity than the first layer.

7. The system of claim 1, wherein a volume of the first layer is at least twice that of a volume of the second layer.

8. The system of claim 1, further comprising:

a draft tube located within the vessel and positioned within the first layer of filter media and the second layer of filter media;

a gas inlet in communication with the draft tube;

a source of gas in communication with the gas inlet;

a backwash fluid inlet fluidly connected to a source of backwash fluid and at least one of the first layer of filter media and the second layer of filter media; and

a contaminant outlet fluidly connected to the vessel.

9. A process for treating a feed stream comprising hydrocarbons and an aqueous-based liquid, the process comprising:

introducing the feed stream to a vessel containing a first layer of filter media and a second layer of filter media, wherein at least the first layer comprises a plurality of composite media particles, each of the composite media particles comprising a mixture of cellulose-based material and a polymer, and wherein the filter media of the second layer has a distinct characteristic relative to the filter media of the first layer, the characteristic selected from the group consisting of a type of material, specific gravity, density, and particle size; and

contacting the feed stream with the first layer of filter media and subsequently the second layer of filter media to produce a treated stream having a concentration of hydrocarbons less than a concentration of hydrocarbons in the feed stream.

10. The process of claim 9, wherein the characteristic comprises specific gravity, and wherein the first layer comprises a lower specific gravity than that of the second layer.

11. The process of claim 9, wherein the characteristic comprises density, and wherein the first layer comprises a lower density than that of the second layer.

12. The process of claim 9, wherein the second layer of filter media comprises walnut shells.

13. The process of claim 9, wherein the second layer also comprises a plurality of composite media particles, each of the composite media particles comprising a mixture of cellulose-based material and a polymer, and wherein the second layer further comprises an additive effective to provide the second layer with a greater specific gravity than the first layer.

14. The process of claim 9, wherein the feed stream further comprises suspended solids, and wherein contacting the feed stream with the first layer of filter media and the second layer of filter media produces a treated stream having a concentration of suspended solids less than a concentration of suspended solids in the feed stream.

15. The process of claim 9, further comprising:

passing a gas through a draft tube in a direction counter a flow of the feed stream, the draft tube located within the vessel and positioned within the first layer of filter media and the second layer of filter media and forming a peripheral zone positioned between a sidewall of the draft tube and a sidewall of the vessel;

passing a backwash fluid through the first and second layers of filter media and the peripheral zone in a direction counter the flow of the feed stream; and

removing at least a portion of the hydrocarbons from the vessel.