CLAIMS

What is claimed is:

1. A process for extracting aromatic hydrocarbons from a mixture feed comprising aromatic hydrocarbons and non-aromatic hydrocarbons, the process comprising:

(A-1) feeding the mixture feed into an extraction column;

(A-2) providing a first lean-solvent stream comprising a polar solvent at a concentration of c(ps) wt%, and heavy components at a total concentration of c(hcom) wt%, based on the total weight of the lean-solvent stream, where $75 \leq c(ps) \leq 99.99$;

(A-3) obtaining a cleansed first lean-solvent stream by (A3-a) contacting the first lean-solvent stream with a first cleansing bed and a second cleansing bed, wherein the first cleansing bed comprises activated carbon that provides a first surface to adsorb the heavy components, and wherein the second cleansing bed comprises an ion exchange resin, alumina, or any combination thereof, that provides a second surface to adsorb one or more impurities formed based on degradation of the polar solvent; and

(A-4) feeding at least a portion of the cleansed first lean-solvent stream into the extraction column.

2. The process of claim 1, wherein c(hcom) wt% ≤ c(sat) wt%, where c(sat) wt% is the saturation concentration of the heavy components in the polar solvent at the temperature of the first lean-solvent stream provided in step (A-2), expressed as weight percentage of the heavy components on the basis of the total weight of the heavy components and the polar solvent; preferably c(hcom) wt% < c(sat) wt%; preferably c(hcom) wt% ≤ 0.8 c(sat) wt%; preferably c(hcom) wt% ≤ 0.6 c(sat) wt%; preferably c(hcom) wt% ≤ 0.5 c(sat) wt%.

3. The process of any of the preceding claims, wherein $0.01 \leq c(hcom) \leq 20$; preferably $0.1 \leqslant c(hcom) \leqslant 15$; preferably $0.5 \leqslant c(hcom) \leqslant 10$; preferably $1 \leqslant c(hcom) \leqslant 5$.

4. The process of any of the preceding claims, wherein the activated carbon has a specific surface area from 1,000 to 1,500 m2/g, as measured using BET.

5. The process of any of the preceding claims, wherein:

the extraction column is an extractive distillation column or a liquid-liquid extraction column.

6. The process of any of the preceding claims, wherein:

the polar solvent is selected from tetraethylene glycol, triethylene glycol, diethylene glycol, ethylene glycol, methoxy triglycol ether, diglycolamine, dipropylene glycol, N-formyl morpholine, N-methyl pyrrolidone, 2,3,4,5-tetrahydrothiophene-1,1-dioxide ("sulfolane"), 3-methylsulfolane and dimethyl sulfoxide, tetramethylenesulfone, mixtures thereof, and/or admixtures with water thereof.

7. The process of any of the preceding claims, wherein:

the first lean-solvent stream has a temperature in a range from 25 to 80 °C when contacting the first cleansing bed; and/or

the first lean-solvent stream has a temperature in a range from 25 to 80 °C when contacting the second cleansing bed.

8. The process of any of the preceding claims, further comprising:

(A-5) feeding a second lean-solvent stream comprising the polar solvent into the extraction column;

wherein in a given time period, the first lean-solvent stream comprises the polar solvent at a total weight of W1, the second lean-solvent stream comprises the polar solvent at a total weight of W2, and $0.5\% \leq W1/(W1+W2) *100\% \leq 10\%$; preferably $0.5\% \leq W1/(W1+W2) *100\% \leq 8\%$; preferably $0.5\% \leq W1/(W1+W2) *100\% \leq 5\%$; more preferably $1\% \leq W1/(W1+W2) *100\% \leq 5\%$; still more preferably $1\% \leq W1/(W1+W2) *100\% \leq 3\%$.

9. The process of claim 8, wherein the first lean-solvent stream and the second lean-solvent stream are derived from a common lean-solvent stream.

10. The process of any of the preceding claims, further comprising:

(A-6) obtaining a bottoms stream from the extraction column, wherein the bottoms stream is rich in aromatic hydrocarbons and the polar solvent relative to the mixture feed;

(A-7) separating at least a portion of the bottoms stream in a solvent recovery column to obtain an upper stream rich in aromatic hydrocarbons and depleted in the polar solvent relative to the bottoms stream, and a third lean-solvent lower stream depleted in aromatic hydrocarbons relative to the bottoms stream; and

(A-8) deriving at least one of the first lean-solvent stream, a second lean-solvent stream, and the common lean-solvent stream from the third lean-solvent lower stream.

11. The process of claim 10, further comprising:

(A-9) deriving a fourth lean-solvent stream from the third lean-solvent stream;

(A-10) regenerating the fourth lean-solvent stream in a steam stripping regenerator and/or a vacuum regenerator to obtain a regenerated lean-solvent stream comprising steam and a bottoms heavy stream; and

(A-11) feeding the regenerated lean-solvent stream into one or both of the solvent recovery column and the extraction column.

12. The process of any of the preceding claims, wherein the extraction column is a liquid/liquid extraction column, and the process does not include regenerating a portion of the polar solvent using a steam regenerator or a vacuum regenerator.

13. The process of any of the preceding claims, further comprising:

(A-12) interrupting or reducing supply of the mixture feed fed into the extraction column; and

(A-13) maintaining a temperature in the extraction column in proximity to temperature thereof before the interrupting or reducing supply of the mixture feed in step (A-12).

14. A process for extracting aromatic hydrocarbons from a mixture feed comprising aromatic hydrocarbons and non-aromatic hydrocarbons, the process comprising:

(B-1) feeding the mixture feed into an extractive distillation column;

(B-2) providing a first lean-solvent stream comprising a polar solvent at a concentration of c(ps) wt%, and heavy components at a total concentration of c(hcom) wt%, based on the total weight of the lean-solvent stream, where $75 \leq c(ps) \leq 99.99$;

(B-3) obtaining a cleansed first lean-solvent stream by (B3-a) contacting the first lean-solvent stream with an primary cleansing bed and a secondary cleansing bed, wherein the primary cleansing bed comprises an ion exchange resin that provides a first surface to adsorb one or more impurities formed based on degradation of the polar solvent, and wherein the secondary cleansing bed comprises activated carbon that provides a second surface to adsorb the heavy components; and

(B-4) feeding at least a portion of the cleansed first lean-solvent stream into the extraction distillation column.

15. The process of claim 14, wherein c(hcom) wt% ≤ c(sat) wt%, where c(sat) wt% is the saturation concentration of the heavy components in the polar solvent at the temperature of the first lean-solvent stream provided in step (B-2), expressed as weight percentage of the heavy components on the basis of the total weight of the heavy components and the polar solvent; preferably c(hcom) wt% < c(sat) wt%; preferably c(hcom) wt% ≤ 0.8 c(sat) wt%; preferably c(hcom) wt% ≤ 0.6 c(sat) wt%; preferably c(hcom) wt% ≤ 0.5 c(sat) wt%.

16. The process of claim 14, wherein the primary cleansing bed comprises a basic ion exchange resin.

17. The process of any of claims 14 to 16, wherein 0.01 ≤ c(hcom) ≤ 20; preferably 0.1 ⩽ c(hcom) ⩽ 15; preferably 0.5 ⩽ c(hcom) ⩽ 10; preferably 1 ⩽ c(hcom) ⩽5.

18. The process of any of claims 14 to 17, wherein the activated carbon has a specific surface area from 1,000 to 1,500 m2/g, as measured using BET.

19. The process of any of claims 14 to 18, wherein:

the first lean-solvent stream has a temperature in a range from 25 to 80 °C (preferably 25 to 65 °C) when contacting the primary cleansing bed; and/or

the first lean-solvent stream has a temperature in a range from 25 to 80 °C (preferably 25 to 65 °C) when contacting the secondary cleansing bed.

20. The process of any of claims 14 to 19, further comprising:

(B-5) feeding a second lean-solvent stream comprising the polar solvent into the extraction column; wherein in a given time period, the first lean-solvent stream comprises the polar solvent at a total weight of W1, the second lean-solvent stream comprises the polar solvent at a total weight of W2, and 0.5% ≤ W1/(W1+W2) *100% ≤ 10%; preferably 0.5% ≤ W1/(W1+W2) *100% ≤ 8%, preferably 0.5% ≤ W1/(W1+W2) *100% ≤ 5%, more preferably 1% ≤ W1/(W1+W2) *100% ≤ 5%, still more preferably 1% ≤ W1/(W1+W2) *100% ≤ 3%.

21. The process of any of claims 14 to 20, further comprising:

(B-6) obtaining a bottoms stream from the extraction column, wherein the bottoms stream is rich in aromatic hydrocarbons and the polar solvent relative to the mixture feed;

(B-7) separating at least a portion of the bottoms stream in a solvent recovery column to obtain an upper stream rich in aromatic hydrocarbons and depleted in the polar solvent relative to the bottoms stream, and a third lean-solvent lower stream depleted in aromatic hydrocarbons relative to the bottoms stream; and

(B-8) deriving at least one of the first lean-solvent stream, a second lean-solvent stream, and the common lean-solvent stream from the third lean-solvent stream.

22. The process of claim 21, further comprising:

(B-9) deriving a fourth lean-solvent stream from the third lean-solvent stream;

(B-10) regenerating the fourth lean-solvent stream in a steam stripping regenerator and/or a vacuum regenerator to obtain a regenerated lean-solvent stream comprising steam and a bottoms heavy stream; and

(B-11) feeding the regenerated lean-solvent stream into one or both of the solvent recovery column and the extraction column.

23. The process of any of claims 14 to 22, further comprising:

(B-12) interrupting or reducing supply of the mixture feed fed into the extraction column; and

(B-13) maintaining a temperature in the extraction column in proximity to temperature thereof before the interrupting or reducing supply of the mixture feed in step (A-12).