What is claimed is:

1. A process for the treatment of a hydrocracking unit bottoms recycle stream containing heavy poly-nuclear aromatic (HPNA) compounds and HPNA precursors to reduce the content of HPNA compounds and precursors, the process comprising:

a. contacting the bottoms recycle stream with an effective amount of adsorbent material in an adsorption vessel to produce an adsorbent-treated bottoms recycle stream having a reduced content of HPNA compounds and HPNA precursors;

b. recovering and introducing the recovered adsorbent-treated bottoms recycle stream into an extraction unit with one or more ionic liquids for a predetermined time to extract the HPNA compounds and HPNA precursors and produce an extraction unit effluent stream and a treated stream;

c. recovering and introducing the effluent stream from the extraction unit containing the mixture of the extracted HPNA compounds and HPNA precursors and the one or more ionic liquids into a separation unit for contact with an organic polar solvent;

d. maintaining the mixture in the separation unit for a time that is sufficient to form a solution of the HPNA compounds and HPNA precursors in the polar solvent;

e. recovering the one or more ionic liquids from the separation unit for re-use in the extraction unit;

f. transferring the solvent containing the HPNA compounds and HPNA precursors to a solvent recovery unit and recovering a solvent stream for re-use in the separation unit;

g. transferring from the extraction unit the remaining treated stream to a liquid-liquid separator and recovering as separate streams

(i) a treated hydrocarbon stream having a substantially reduced content of HPNA compounds,

(ii) residual ionic liquids, and

(iii) HPNA compounds and HPNA precursors.

2. A process for the treatment of a hydrocracking unit bottoms recycle stream containing heavy poly-nuclear aromatic (HPNA) compounds and HPNA precursors to reduce the content of HPNA compound and precursors, the process comprising:

a. introducing the bottoms recycle stream into an extraction unit with one or more ionic liquids for a predetermined period of time to extract the HPNA compounds and HPNA precursors and to produce an extraction unit effluent stream and a treated stream;

b. introducing the extraction unit effluent stream containing the extracted HPNA compounds and HPNA precursors and the one or more ionic liquids into a separation unit for contact with an organic polar solvent;

c. mixing the liquids in the separation unit for a time that is sufficient to form a solution of the HPNA compounds and HPNA precursors in the polar solvent;

d. recovering the one or more ionic liquids from the separation unit for re-use in the extraction unit;

e. transferring the solvent containing the HPNA compounds and HPNA precursors to a solvent recovery unit and recovering a solvent stream for re-use in the separation unit;

f. transferring from the extraction unit the remaining treated stream to a liquid-liquid separator and recovering as separate streams

(i) a treated hydrocarbon recycle stream having a substantially reduced content of HPNA compounds and HPNA precursors,

(ii) residual ionic liquids, and

(iii) HPNA compounds and HPNA precursors;

g. contacting the treated hydrocarbon recycle stream with an effective amount of adsorbent material to produce an adsorbent-treated hydrocarbon recycle stream; and

h. recovering an adsorbent-treated recycle stream having a reduced content of HPNA compounds.

3. The process of claim 1 or 2, in which a fresh hydrocracking unit feed is combined with the hydrocracking unit bottoms recycle stream and the combined stream is treated.

4. The process of claim 1 or 2 in which the one or more ionic liquids is of the general formula $Q^+ A^-$,

wherein the A^- ion is selected from the group consisting of halide anions, nitrate, sulfate, phosphate, acetate, haloacetates, tetrafluoroborate, tetrachloroborate, hexafluorophosphate, hexafluoroantimonate, fluorosulfonate, alkyl sulfonates, perfluoroalkyl sulfonates, bis(perfluoroalkylsulfonyl)amides, tris-trifluoromethanesulfononyl methylide of the formula $C(CF_3SO_2)_3$-, unsubstituted arenesulfonates, arenesulfonates substituted by halogen or haloalkyl groups, and

wherein the Q^+ ion is an ammonium cation, a phosphonium cation or a sulfonium cation that will form a liquid compound with an A^- ion.

5. The process of claim 4 in which the one or more ionic liquids is selected from the group consisting of N-butyl-pyridinium hexafluorophosphate, N-ethyl-pyridinium tetrafluoroborate, pyridinium fluorosulfonate, butyl-3-methyl-1-imidazolium tetrafluoroborate, butyl-3-methyl-1-imidazolium bis-trifluoromethane-sulfonyl amide, triethylsulfonium bis-trifluoromethane-sulfonyl amide, butyl-3-methyl-1-imidazolium hexafluoro-antimonate, butyl-3-methyl-1-imidazolium hexafluorophosphate, butyl-3-methyl-1-imidazolium trifluoroacetate, butyl-3-methyl-1-imidazolium trifluoromethylsulfonate, butyl-3-methyl-1-imidazolium bis(trifluoromethylsulfonyl)-amide, trimethyl-phenylammonium hexafluorophosphate, tetrabutylphosphonium tetrafluoroborate, and mixtures thereof.

6. The process of claim 1 or 2 in which the extraction unit operates at a temperature in the range of from 20º to 200ºC, a pressure in the range of from 1 to 30 bars, and at a mole ratio of ionic liquid-to-HPNA in the range of from 1:1 to 10:1.

7. The process of claim 1 or 2 in which the extraction unit is selected from the group consisting of tray columns, spray columns, packed towers, rotating disc contactors and pulse columns.

8. The process of claim 1 or 2 in which the adsorbent material is in an adsorption column in the form of a packed bed or slurry bed.

9. The process of claim 8 in which the adsorption column operates at a temperature in the range of from 20º to 200ºC and a pressure in the range of from 1 to 30 bars.

10. The process of claim 1 or 2 in which the adsorbent material is selected from the group consisting of attapulgus clay, alumina, silica, activated carbon, natural and synthetic zeolites, spent catalysts, silica-titania and titania.

11. The process of claim 1 or 2 in which the organic polar solvent has an overall solubility parameter greater than about 8.5.

12. The process of claim 11 in which the organic polar solvent is selected from the group consisting of toluene, benzene, xylene, tetrahydrofuran, and mixture thereof.