CLAIMS

1. Process for treating a feedstock comprising a plastics pyrolysis oil, comprising:

a) a hydrogenation step performed in a hydrogenation reaction section, using at least one fixed-bed reactor containing n catalytic beds, n being an integer greater than or equal to 1, each comprising at least one hydrogenation catalyst, said hydrogenation reaction section being fed at least with said feedstock and a gas stream comprising hydrogen, said hydrogenation reaction section being used at an average temperature of between 140 and 400°C, a partial pressure of hydrogen of between 1.0 and 10.0 MPa abs. and an hourly space velocity of between 0.1 and 10.0 h^{-1}, said hydrogenation reaction section having an outlet temperature and an inlet temperature, the outlet temperature of the reaction section of step a) being at least 15°C higher than the inlet temperature of the reaction section of step a), to obtain a hydrogenated effluent,

b) a hydrotreatment step performed in a hydrotreatment reaction section, using at least one fixed-bed reactor containing n catalytic beds, n being an integer greater than or equal to 1, each comprising at least one hydrotreatment catalyst, said hydrotreatment reaction section being fed at least with said hydrogenated effluent obtained from step a) and a gas stream comprising hydrogen, said hydrotreatment reaction section being used at an average temperature of between 250 and 430°C, a partial pressure of hydrogen of between 1.0 and 10.0 MPa abs. and an hourly space velocity of between 0.1 and 10.0 h^{-1}, the average temperature of the reaction section of step b) being higher than the average temperature of the hydrogenation reaction section of step a), to obtain a hydrotreated effluent,

b') optionally, a hydrocracking step performed in a hydrocracking reaction section, using at least one fixed bed containing n catalytic beds, n being an integer greater than or equal to 1, each comprising at least one hydrocracking catalyst, said hydrocracking reaction section being fed at least with said hydrotreated effluent obtained from step b) and/or with the cut comprising compounds having a boiling point greater than 175°C obtained from step d) and a gas stream comprising hydrogen, said hydrocracking reaction section being used at an average temperature of between 250 and 450°C, a partial pressure of hydrogen of between 1.5 and 20.0 MPa abs. and an hourly space velocity of between 0.1 and 10.0 h^{-1}, to obtain a hydrocracked effluent which is sent to the separation step c),

c) a separation step, fed with the hydrotreated effluent obtained from step b) or with the hydrocracked effluent obtained from step b') and an aqueous solution, said step being performed at a temperature of between 50 and 370°C, to obtain at least one gaseous effluent, an aqueous effluent and a hydrocarbon-based effluent,

d) optionally a step of fractionating all or a portion of the hydrocarbon-based effluent obtained from step c), to obtain at least one gaseous effluent and at least one cut comprising compounds with a boiling point of less than or equal to 175°C and one hydrocarbon-based cut comprising compounds with a boiling point of greater than 175°C.

2. Process according to the preceding claim, comprising step d).

3. Process according to either of the preceding claims, comprising step b').

4. Process according to one of the preceding claims, in which the amount of the gas stream comprising hydrogen feeding said reaction section of step a) is such that hydrogen coverage is between 50 and 1000 Nm^3 of hydrogen per m^3 of feedstock.

5. Process according to the preceding claim, in which the amount of the gas stream comprising hydrogen feeding said reaction section of step a) is such that hydrogen coverage is between 200 and 300 Nm^3 of hydrogen per m^3 of feedstock.

6. Process according to one of the preceding claims, in which the outlet temperature of step a) is at least 30°C higher than the inlet temperature of step a).

7. Process according to one of the preceding claims, in which at least one fraction of the hydrocarbon-based effluent obtained from the separation step c) or at least one fraction of naphtha cut comprising compounds with a boiling point of less than or equal to 175°C obtained from the fractionation step d) is sent into the hydrogenation step a) and/or the hydrotreatment step b).

8. Process according to one of the preceding claims, in which at least one fraction of the cut comprising compounds with a boiling point of greater than 175°C obtained from the fractionation step d) is sent to the hydrogenation step a) and/or the hydrotreatment step b) and/or the hydrocracking step b').

9. Process according to one of the preceding claims, comprising a step a0) of pretreating the feedstock comprising a plastics pyrolysis oil, said pretreatment step being carried out upstream of the hydrogenation step a) and comprises a filtration step and/or an electrostatic separation step and/or a step of washing by means of an aqueous solution and/or an adsorption step.

10. Process according to one of the preceding claims, in which the hydrocarbon-based effluent obtained from the separation step c), or at least one of the two liquid hydrocarbon-based streams obtained from step d), is totally or partly sent into a steam

cracking step e) performed in at least one pyrolysis furnace at a temperature of between 700 and 900°C and at a pressure of between 0.05 and 0.3 MPa relative.

11. Process according to one of the preceding claims, in which the reaction section of step a) uses at least two reactors operating in permutable mode.

12. Process according to one of the preceding claims, in which a stream containing an amine is injected upstream of step a).

13. Process according to one of the preceding claims, in which said hydrogenation catalyst comprises a support chosen from alumina, silica, silica-aluminas, magnesia, clays and mixtures thereof and a hydro-dehydrogenating function comprising either at least one group VIII element and at least one group VIB element, or at least one group VIII element.

14. Process according to one of the preceding claims, in which said hydrotreatment catalyst comprises a support chosen from the group consisting of alumina, silica, silica-aluminas, magnesia, clays and mixtures thereof and a hydro-dehydrogenating function comprising at least one group VIII element and/or at least one group VIB element.

15. Process according to one of the preceding claims, which process also comprises a second hydrocracking step b'') performed in a hydrocracking reaction section, using at least one fixed bed containing n catalytic beds, n being an integer greater than or equal to 1, each comprising at least one hydrocracking catalyst, said hydrocracking reaction section being fed with the cut comprising compounds having a boiling point greater than 175°C obtained from step d) and a gas stream comprising hydrogen, said hydrocracking reaction section being used at a temperature of between 250 and 450°C, a partial pressure of hydrogen of between 1.5 and 20.0 MPa abs. and an hourly space velocity of between 0.1 and 10.0 h^{-1}, to obtain a hydrocracked effluent which is sent to the separation step c).

16. Process according to one of the preceding claims, in which said hydrocracking catalyst comprises a support chosen from halogenated aluminas, combinations of boron and aluminium oxides, amorphous silica-aluminas and zeolites and a hydro-dehydrogenating function comprising at least one group VIB metal chosen from chromium, molybdenum and tungsten, alone or as a mixture, and/or at least one group VIII metal chosen from iron, cobalt, nickel, ruthenium, rhodium, palladium and platinum.