CLAIMS

1. A process for treating a feedstock comprising a plastics pyrolysis oil, said plastics pyrolysis oil comprising mono- and/or diolefins, metals and halogenated compounds, said process comprising at least the following steps:

a) a selective hydrogenation step performed in a reaction section fed with said feedstock maintained in the liquid phase and a gaseous stream comprising hydrogen, in the presence of at least one selective hydrogenation catalyst, at a temperature of between 100 and 250°C, a partial pressure of hydrogen of between 1.0 and 10.0 MPa abs. and an hourly space velocity of between 1.0 and 10.0 h^{-1}, to obtain a hydrogenated effluent;

b) a hydrotreatment step performed in a hydrotreatment reaction section, comprising a fixed-bed reactor containing n catalytic beds, n being an integer greater than or equal to 1, placed in series and each comprising at least one hydrotreatment catalyst, said hydrotreatment reaction section being fed, at the first catalytic bed, with said hydrogenated effluent obtained from step a) and a gaseous stream comprising hydrogen and used at a 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}, to obtain a hydrotreatment effluent;

c) a separation step performed in at least one washing/separation section, comprising injection of an aqueous solution into the hydrotreating effluent resulting from step b), upstream of the washing/separation section, said washing/separation section being fed with the hydrotreatment effluent obtained from step b) and the 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 effluent.

2. The process as claimed in claim 1, comprising a step a_0) of pretreating the feedstock comprising a plastics pyrolysis oil, said pretreatment step being performed prior to the selective hydrogenation step a) in an adsorption section fed with said feedstock and operating at a temperature of between 0 and 150°C, preferably between 5 and 100°C, and at a pressure of between 0.15 and 10.0 MPa abs., preferably between 0.2 and 1.0 MPa abs., in the presence of at least an adsorbent having a specific surface area of greater than or equal to 100 m^2/g, preferably greater than or equal to 200 m^2/g, to obtain a pretreated feedstock which feeds the reaction section of step a).

3. The process as claimed in either of the preceding claims, wherein the selective hydrogenation step a) is performed at a temperature of between 110 and 200°C, preferably between 130 and 180°C, in step a).

4. The process as claimed in one of the preceding claims, wherein the amount of the gaseous stream feeding the reaction section of step a) is such that the hydrogen coverage is between 1 and 50 Nm^3 of hydrogen per m^3 of feedstock, and preferably between 5 and 20 Nm^3 of hydrogen per m^3 of feedstock.

5. The process as claimed in one of the preceding claims, wherein the reaction section of step a) uses at least two reactors operating in a permutable system.

6. The process as claimed in one of the preceding claims, wherein said at least selective hydrogenation catalyst comprises a support, preferably 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, preferably chosen from the group consisting of nickel and cobalt, and/or at least one group VIB element, preferably chosen from the group consisting of molybdenum and tungsten.

7. The process as claimed in claim 6, wherein said at least one selective hydrogenation catalyst comprises less than 1% by weight of nickel, expressed as nickel oxide NiO, relative to the weight of said catalyst, and less than 5% by weight of molybdenum, expressed as molybdenum oxide MoO_3, relative to the weight of said catalyst, on an alumina support.

8. The process as claimed in one of the preceding claims, wherein an additional gaseous stream comprising hydrogen is introduced at the inlet of each catalytic bed from the second catalytic bed, of the hydrotreatment reaction section of step b).

9. The process as claimed in one of the preceding claims, wherein the amount of the gaseous stream feeding the hydrotreatment reaction section of step b) is such that the hydrogen coverage is between 50 and 1000 Nm^3 of hydrogen per m^3 of hydrogenated effluent obtained from step a), preferably between 50 and 500 Nm^3 of hydrogen per m^3 of hydrogenated effluent obtained from step a), preferably between 100 and 300 Nm^3 of hydrogen per m^3 of hydrogenated effluent obtained from step a).

10. The process as claimed in one of the preceding claims, wherein said at least one hydrotreatment catalyst comprises a support, preferably 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, preferably chosen from the group consisting of nickel and cobalt, and/or at least one group VIB element, preferably chosen from the group consisting of molybdenum and tungsten.

11. The process as claimed in one of the preceding claims, wherein said at least one hydrotreatment catalyst has a specific surface area of greater than or equal to 250 m^2/g, preferably greater than or equal to 300 m^2/g.

12. The process as claimed in one of the preceding claims, also comprising a fractionation step d).

13. The process as claimed in one of the preceding claims, also comprising 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.