CLAIMS

1. A process for producing benzene comprising the steps of:
(a) separating a source feedstream comprising C5-C12 hydrocarbons including benzene and alkylbenzenes into a first feedstream comprising a higher proportion of benzene than the source feedstream and a second feedstream comprising a lower proportion of benzene than the source feedstream and subsequently
(b) contacting the first feedstream in the presence of hydrogen with a first hydrocracking catalyst comprising 0.01-1 wt-% hydrogenation metal in relation to the total catalyst weight and a zeolite having a pore size of 5-8 Å and a silica (SiO2) to alumina (Al2O3) molar ratio of 5-200 under first process conditions to produce a first product stream comprising benzene, wherein the first process conditions include a temperature of 425-580 °C, a pressure of 300-5000 kPa gauge and a Weight Hourly Space Velocity of 0.1-15 h^{-1}, and
(c) contacting the second feedstream with hydrogen under second process conditions to produce a second product stream comprising benzene, wherein
i) the second process conditions are suitable for hydrocracking and step (c) involves contacting the second feedstream in the presence of hydrogen with a second hydrocracking catalyst comprising 0.01-1 wt-% hydrogenation metal in relation to the total catalyst weight and a zeolite having a pore size of 5-8 Å and a silica (SiO2) to alumina (Al2O3) molar ratio of 5-200 under the second process conditions which include a temperature of 300-600 °C, a pressure of 300-5000 kPa gauge and a Weight Hourly Space Velocity of 0.1-15 h^{-1},
ii) the second process conditions are suitable for toluene disproportionation and involve contacting the second feedstream with a toluene disproportionation catalyst at a temperature of 400 °C to 550 °C , a pressure of 1 to 100 atmospheres (0.1 MPa to 10 MPa), and a Weight Hourly Space Velocity of 0.5 to 50 hr^{-1} or
iii) the second process conditions are suitable for hydrodealkylation at a temperature of 600-800 °C, a pressure of 3-10 MPa gauge, and a Weight Hourly Space Velocity of 0.5-2 h^{-1}.

2. The process according to claim 1, wherein the separation of the source feedstream into the first feedstream and the second feedstream is performed such that the first feedstream comprises C6- hydrocarbons and at least one of

non-aromatic C7 hydrocarbons and the second feedstream comprises remaining hydrocarbons including toluene.

3. The process according to any one of the preceding claims, wherein the first hydrocracking catalyst comprises less than 0.01 parts tin and less than 0.02 parts lead and less than 0.01 parts bismuth on the basis of 100 parts by weight of the total catalyst.

4. The process according to any one of the preceding claims, wherein BTX is separated from the first product stream and benzene is separated from the BTX.

5. The process according to any one of the preceding claims, wherein toluene in the first product stream is recycled back to be included in the second feed stream.

6. The process according to any one of claims 1-5, wherein step c) involves option i) and BTX is separated from the second product stream optionally after the second product stream is combined with the first product stream, and benzene is separated from the BTX.

7. The process according to claim 6, wherein toluene in the second product stream is recycled back to be included in the second feed stream.

8. The process according to any one of claims 1-5, wherein step c) involves option ii) or iii) and BTX is separated from the second product stream and benzene is separated from the BTX.

9. The process according to claim 8, wherein the benzene from the second product stream is recycled back to be included in the first feed stream.

10. The process according to any one of claims 1-5, wherein step c) involves option ii) or iii) and the second product stream is recycled back to be included in the source feed stream.

11. The process according to any one of the preceding claims, wherein the first feedstream is subjected to hydrogenation before step (b) and/or the second feedstream is subjected to hydrogenation before step (c).

12. The process according to any one of the preceding claims, wherein the source feedstream comprises pyrolysis gasoline, straight run naphtha, light coker naphtha and coke oven light oil or mixtures thereof.

13. The process according to any one of the preceding claims, wherein the proportion of benzene in the total amount of BTX in the second feed stream is at most 10 wt%.