PCT CLAIMS

1. A process for producing ~~phenol~~ cyclohexylbenzene, the process comprising:

(a) reacting benzene with a hydrogen-containing stream in the presence of a hydroalkylation catalyst under conditions effective to produce a hydroalkylation reaction effluent comprising cyclohexylbenzene, benzene, and hydrogen;

(b) removing a first stream from the hydroalkylation reaction effluent, said first stream comprising hydrogen and benzene; and

(c) washing at least a portion of the first stream with a second stream containing cyclohexylbenzene to produce a benzene-depleted hydrogen stream and a wash stream containing cyclohexylbenzene and benzene.

2. The process of claim 1, wherein the first stream is substantially in the vapor phase and the second stream is substantially in the liquid phase.

3. The process of claim 1 or claim 2, wherein at least 50 wt% of the benzene contained in said at least a portion of the first stream is transferred to the wash stream in said washing (c), the wt% based upon the weight of said at least a portion of the first stream.

4. The process of any one of the preceding claims, wherein the second stream contains less than 1 wt% of benzene, based upon the weight of the second stream.

5. The process of any one of the preceding claims, wherein the benzene-depleted hydrogen stream contains less than 0.1 wt% benzene, based upon the weight of the benzene-depleted hydrogen stream.

6. The process of any one of the preceding claims, wherein the benzene-depleted hydrogen stream contains less than 0.01 wt% benzene, based upon the weight of the benzene-depleted hydrogen stream.

7. The process of any one of the preceding claims, wherein the first stream contains at least 10 mol% of the hydrogen from the hydroalkylation reaction effluent, the mol% based upon the total moles of the hydroalkylation reaction effluent.

8. The process of any one of the preceding claims, wherein the hydrogen-containing stream further comprises at least one inert material selected from methane, nitrogen, ethane, and propane, and at least a portion of the inert material is present in the hydroalkylation reaction effluent and the benzene-depleted hydrogen stream.

9. The process of claim 8, wherein at least a portion of the benzene-depleted hydrogen stream is removed from the process.

22. The process of any one of claims 18-21, wherein the hydrogenation catalyst comprises about 0.1 wt% to about 10 wt% of the hydrogenation component, the wt% based upon total weight of the hydrogenation catalyst.

23. The process of any one of claims 18-22, wherein the hydrogenation conditions comprise a temperature of about 10°C to about 200°C and a pressure of about 100 kPa, gauge to about 3450 kPa, gauge.

24. The process of any one of claims 18-23, and further comprising:

(g) oxidizing at least a portion of the cyclohexylbenzene in said hydrogenated product stream to cyclohexylbenzene hydroperoxide; and

(h) cleaving at least a portion of the cyclohexylbenzene hydroperoxide produced in (g) to produce phenol and cyclohexanone.

25. A process for producing ~~phenol~~ cyclohexylbenzene, the process comprising:

(a) reacting benzene with a source of hydrogen containing methane in the presence of a hydroalkylation catalyst under conditions effective to produce a hydroalkylation reaction effluent comprising cyclohexylbenzene, benzene, hydrogen, and at least one olefinic byproduct;

(b) removing a vapor stream from the hydroalkylation reaction effluent, said vapor stream comprising hydrogen, methane, and benzene;

(c) washing the vapor stream with a liquid cyclohexylbenzene-containing stream to produce a benzene-depleted stream containing hydrogen and methane and a wash stream containing cyclohexylbenzene and benzene;

(d) removing a second stream from the hydroalkylation reaction effluent, said second stream comprising at least a portion of the cyclohexylbenzene and the at least one olefinic by-product;

(e) contacting said second stream with said benzene-depleted stream in the presence of a hydrogenation catalyst under conditions such that at least a portion of the hydrogen in the benzene-depleted stream reacts with the at least one olefinic by-product to produce a hydrogenated product stream and a hydrogen-depleted gas stream containing methane; and

(f) purging said hydrogen-depleted gas stream from the process.