CLAIMS

1. A process for producing a mixture of cyclohexanone and cyclohexanol, the process comprising:

(a) contacting a feed comprising cyclohexanone and phenol with hydrogen in the presence of a hydrogenation catalyst under hydrogenation conditions effective to convert at least part of the cyclohexanone and/or phenol in the feed into cyclohexanol and thereby produce a hydrogenation product containing cyclohexanone and cyclohexanol;

wherein the hydrogenation catalyst comprises platinum, palladium, tin and an inorganic oxide material.

2. The process of claim 1, further comprising:

(b) obtaining a mixture comprising at least 90 wt% of cyclohexanone and cyclohexanol from the hydrogenation product.

3. The process of claim 1 or claim 2, wherein the weight ratio of cyclohexanone to phenol in the feed is from 0.1 to 10.0.

~~4. The process of any one of claims 1 to 3, wherein the hydrogenation catalyst comprises at least one of palladium, platinum, ruthenium, rhodium, iridium, osmium, nickel, zinc, tin, cobalt and compounds and mixtures thereof.~~

~~5. The process of claim 4, wherein the hydrogenation catalyst comprises both platinum and palladium.~~

~~6~~4. The process of claim ~~5~~1, wherein the hydrogenation catalyst comprises platinum and palladium at a molar ratio from 0.1 to 10.0.

~~7~~5. The process of any one of claims ~~4 to 6~~1 to 4, wherein the hydrogenation catalyst ~~further~~ comprises at least one of the following inorganic oxides: Al_2O_3, SiO_2, ZrO_2, MgO, CaO, Gd_2O_3, GeO_2, Y_2O_3, rare earth oxides, TiO_2, SnO_2, and combinations and mixtures thereof.

86. The process of claim 75, wherein the hydrogenation catalyst comprises at least one of SnO and SnO_2 and at least one of SiO_2 and Al_2O_3.

97. A process for producing a mixture of cyclohexanone and cyclohexanol, the process comprising:

(a) cleaving a cleavage feed comprising cyclohexylbenzene hydroperoxide to produce a cleavage effluent comprising phenol and cyclohexanone;

(b) obtaining a hydrogenation feed comprising phenol and/or cyclohexanone from at least a portion of the cleavage effluent; and

(c) contacting the hydrogenation feed with hydrogen in the presence of a hydrogenation catalyst in a hydrogenation reaction zone under hydrogenation conditions effective to convert at least part of the phenol and/or cyclohexanone in the hydrogenation feed into cyclohexanol and thereby produce a hydrogenation product containing cyclohexanone and cyclohexanol;

wherein the hydrogenation catalyst comprises platinum, palladium, tin and an inorganic oxide material.

810. The process of claim 97, further comprising:

(d) obtaining a mixture comprising at least 90 wt% of cyclohexanone and cyclohexanol from the hydrogenation product.

119. The process of claim 9 7 or claim 108, wherein the obtaining step (b) comprises:

(b1) obtaining from the cleavage effluent a first fraction having a higher cyclohexanone concentration than the cleavage effluent and a second fraction having a lower cyclohexanone concentration than the cleavage effluent; and

(b2) forming the hydrogenation feed from at least a portion of the first fraction.

1210. The process of claim 119, wherein the obtaining step (b1) comprises distillation.

13. The process of any one of claims 9 to 12, wherein the hydrogenation catalyst in step (c) is selected from the group consisting of palladium, platinum, ruthenium, rhodium, iridium, osmium, nickel, zinc, tin, cobalt and compounds and mixtures thereof.

~~14. The process of claim 13, wherein the hydrogenation catalyst comprises both platinum and palladium.~~

~~15~~11. The process of claim ~~14~~7, wherein the hydrogenation catalyst comprise platinum and palladium at a molar ratio from 0.1 to 10.0.

~~16~~12. The process of any one of claims ~~9~~7 to ~~15~~11, wherein the hydrogenation catalyst ~~further~~ comprises at least one of the following inorganic oxides: Al_2O_3, SiO_2, ZrO_2, MgO, CaO, Gd_2O_3, GeO_2, Y_2O_3, rare earth oxides, TiO_2, SnO_2, and combinations and mixtures thereof.

~~17~~13. The process of claim ~~16~~12, wherein the hydrogenation catalyst comprises at least one of SnO and SnO_2 and at least one of SiO_2 and Al_2O_3.

~~18~~14. The process of any one of claims ~~9~~7 to ~~17~~13, wherein at least a portion of the cyclohexylbenzene hydroperoxide in step (a) is provided by:

(a1) contacting benzene and hydrogen with a hydroalkylation catalyst under hydroalkylation conditions to produce cyclohexylbenzene; and

(a2) oxidizing at least part of the cyclohexylbenzene from step (a1) to produce an oxidation effluent comprising cyclohexylbenzene hydroperoxide.

~~19~~15. ~~The~~ A hydrogenation catalyst comprising platinum, palladium, tin and an inorganic oxide material.

~~20~~16. The hydrogenation catalyst of claim ~~19~~15, wherein the molar ratio of platinum to palladium in the catalyst is from 0.1 to 10.0.

~~21~~17. The hydrogenation catalyst of claim ~~18~~15 or ~~19~~16, wherein the inorganic oxide material comprises at least one of Al_2O_3, SiO_2, ZrO_2, MgO, CaO, Gd_2O_3, GeO_2, Y_2O_3, rare earth oxides, TiO_2, SnO, SnO_2, and combinations and mixtures thereof.

~~22~~18. The hydrogenation catalyst of claim ~~21~~17, wherein the inorganic oxide material comprises SiO_2 and/or Al_2O_3.

~~23~~19. The hydrogenation catalyst of claim ~~22~~18, wherein the inorganic oxide material comprises at least one of Al_2O_3 and SiO_2, and at least one of SnO and SnO_2.

~~24~~20. The hydrogenation catalyst of claim ~~23~~19, wherein the molar ratio of SnO to SnO_2 is from 0.001 to 1000.

~~25~~21. The hydrogenation catalyst of any one of claims ~~19~~ 15 to ~~24~~20, wherein the total concentration of platinum and palladium is from 0.001 wt% to 5.0 wt%, based on the total weight of the catalyst.