CLAIMS

1. A process for producing phenol and/or cyclohexanone, the process comprising:

(a) contacting cyclohexylbenzene with an oxygen-containing gas to produce an oxidation effluent containing cyclohexylbenzene hydroperoxide;

(b) contacting at least a portion of the oxidation effluent containing cyclohexylbenzene hydroperoxide with a cleavage catalyst to produce a cleavage effluent containing phenol, cyclohexanone and by-products including phenylcyclohexanol;

(b1) optionally neutralizing the cleavage effluent to produce a neutralized product thereof;

wherein the cleavage effluent and/or the neutralized product thereof comprise at least one heteroatom-containing compound, said heteroatom comprises an atom other than carbon, hydrogen, and oxygen;

(c) separating at least a portion of the at least one heteroatom-containing compound from the cleavage effluent and/or the neutralized product thereof to produce a cleavage fraction containing at least a portion of the phenylcyclohexanol and at least 1.0% less of the at least one heteroatom-containing compound compared to before separating; and

(d) contacting at least a portion of the cleavage fraction containing phenylcyclohexanol with a dehydration catalyst comprising a molecular sieve of the MCM-22 type to convert at least a portion of the phenylcyclohexanol to phenylcyclohexene.

2. The process of claim 1, wherein the contacting step (a) is conducted in the presence of an oxidation catalyst containing at least one heteroatom and the cleavage effluent produced in step (b) includes at least one heteroatom-containing compound derived from the oxidation catalyst.

3. The process of claim 2, wherein the oxidation catalyst contains ~~nitrogen~~ N-hydroxy substituted cyclic imide.

~~4. The process of claim 2 or claim 3, wherein the oxidation catalyst comprises a cyclic imide.~~

~~5.~~4. The process of any one of the preceding claims, wherein the cleavage catalyst contains at least one heteroatom and the cleavage effluent includes at least one heteroatom-containing compound derived from the cleavage catalyst.

~~6.~~5. The process of claim ~~5~~ 4, wherein the cleavage catalyst contains sulfur.

~~7.~~6. The process of claim ~~5~~ 4 or claim ~~6~~ 5, wherein the cleavage catalyst comprises sulfuric acid.

~~8.~~7. The process of any one of the preceding claims, wherein step (b1) is conducted and comprises contacting the cleavage effluent with a base to form the neutralized product containing an acid-base complexation compound containing at least one heteroatom.

~~9.~~8. The process of claim ~~8~~ 7, wherein the base comprises at least one heteroatom.

~~10.~~9. The process of claim ~~8~~ 7 or claim ~~9~~ 8, wherein the base comprises nitrogen.

~~11.~~10. The process of any one of the preceding claims, wherein the separating step (c) is conducted in a liquid-vapor flash device.

~~12.~~11. The process of any one of the preceding claims, wherein the separating step (c) is conducted in a first distillation column.

~~13.~~12. The process of claim ~~12~~ 11, wherein the first distillation column comprises a dividing wall distillation column.

~~14.~~13. The process of claim ~~12~~ 11 or claim ~~13~~ 12, wherein at least a portion of the product produced in the contacting step (d) is fed back to the first distillation column.

~~15.~~14. The process of any one of the preceding claims, further comprising:

(f) supplying at least a portion of the phenylcyclohexene produced in the contacting step (d) to the contacting step (a).

~~16.~~15. The process of any one of the preceding claims, further comprising:

(g) contacting at least a portion of the phenylcyclohexene produced in the contacting step (d) with hydrogen to convert at least a portion of the phenylcyclohexene to cyclohexylbenzene.

~~17.~~16. The process of claim ~~16~~ 15, further comprising:

(h) supplying at least a portion of the cyclohexylbenzene produced in the contacting step (g) to the contacting step (a).

~~18.~~17. The process of any one of the preceding claims, wherein at least a portion of the cyclohexylbenzene in the contacting step (a) is produced by alkylation of benzene with cyclohexene.

~~19.~~18. The process of any one of the preceding claims, wherein at least a portion of the cyclohexylbenzene in step (a) is produced by reaction of benzene with hydrogen in the presence of a hydroalkylation catalyst.

~~20.~~19. The process of claim ~~19~~ 18, wherein the hydroalkylation catalyst comprises a solid acid alkylation component and a hydrogenating metal component.

~~21.~~20. The process of claim ~~20~~ 19, wherein the solid acid alkylation component comprises a molecular sieve.

~~22.~~21. The process of claim ~~20~~ 19 or claim ~~21~~ 20, wherein the solid acid alkylation component comprises a molecular sieve of the MCM-22 type.