

CLAIMS

What is claimed is:

1. A method for treating a residual stream from the manufacture of bisphenol, wherein the residual stream comprises unreacted phenols, bisphenol isomers, trisphenols, organic sulfides and water and wherein the method comprises:

(a1) contacting at least a portion of the residual stream or a reaction product thereof with an acidic catalyst under conditions sufficient to allow acid-catalyzed hydrolysis of organic sulfides in the residual stream to the corresponding thiols and produce an effluent stream; and

(b1) distilling at least a portion of the effluent stream to recover distillate products comprising phenols and thiols and produce a bottoms product comprising bisphenol isomers and trisphenols, and having a lower content of organic sulfides than the residual stream.

2. The method of claim 1, which further comprises recycling at least part of the distillate products to the bisphenol manufacturing process.

3. The method of claim 1 or claim 2, in which the acidic catalyst comprises an acidic ion exchange resin.

4. The method of any preceding claim, in which the acidic catalyst comprises a sulfonated acidic ion exchange resin with 2% - 6% crosslinking.

5. The method of any preceding claim, in which the recovered thiol is an alkanethiol.

6. The method of any preceding claim, in which the contacting step (a1) is conducted at a temperature from about 60 to 110°C.

7. The method of any preceding claim, in which the residual stream comprises hydrolyzable organic sulfides in an amount up to 6,000 ppmwt and water present in a sufficient amount that the molar ratio of water to hydrolyzable organic sulfides is at least 4:1.

8. The method of any preceding claim, in which the residual stream comprises a mother liquor stream from a crystallization step to recover a bisphenol product.

9. A method for producing bisphenol-A comprising:

(a2) condensing acetone with a molar excess of phenol in the presence of a first solid acid catalyst promoted with a thiol under conditions effective to produce a first effluent stream comprising bisphenol isomers, unreacted phenol, trisphenols, organic sulfides and water;

(b2) recovering bisphenol-A from the first effluent stream to leave a residual stream comprising a mixture of bisphenol isomers depleted in bisphenol-A, unreacted phenol, trisphenols, organic sulfides and water;

(c2) contacting at least part of the residual stream with a second catalyst under conditions effective to isomerize bisphenol isomers to bisphenol-A and to hydrolyze organic sulfides to the corresponding thiols and produce a second effluent stream;

(d2) dividing the second effluent stream into a recycle stream and a purge stream;

(e2) supplying the recycle stream to step (a2) or step (b2); and

(f2) distilling the purge stream or a reaction product thereof to recover distillate products comprising phenol and thiols and produce a bottoms product comprising bisphenol isomers and trisphenols and having a lower content of organic sulfides than the residual stream.

10. The method of claim 9, which further comprises recycling at least part of the distillate products to the condensing step (a2).

11. The method of claim 9 or claim 10, in which the second catalyst comprises an acidic ion exchange resin.

12. The method of any one of claims 9 to 11, in which the second catalyst comprises a sulfonated acidic ion exchange resin with 2% - 6% crosslinking.

13. The method of any one of claims 9 to 12, in which the thiol promoter and the recovered thiol are alkanethiols.
14. The method of any one of claims 9 to 13, in which the contacting step (c2) is conducted at a temperature from about 60 to 110°C.
15. The method of any one of claims 9 to 14, in which the purge stream is contacted with a third catalyst under conditions effective to hydrolyze organic sulfides to the corresponding thiols prior to distilling the reaction product thereof in step (f2).
16. The method of claim 15, in which the third catalyst comprises an acidic ion exchange resin.
17. The method of claim 15 or claim 16, in which the third catalyst comprises a sulfonated acidic ion exchange resin with 2% - 6% crosslinking.
18. The method of any one of claims 15 to 17, in which the contacting with a third catalyst is conducted at a temperature from about 60 to 110°C.
19. The method of any one of claims 9 to 18, in which the residual stream comprises hydrolyzable organic sulfides in an amount up to 6,000 ppmwt and water present in a sufficient amount that the molar ratio of water to hydrolyzable organic sulfides is at least 4:1.
20. The method of any one of claims 9 to 19, in which the recovering step (b2) comprises crystallization and the residual stream comprises a mother liquor stream from the crystallization.
21. A method for producing bisphenol-A comprising:
 - (a3) condensing acetone with a molar excess of phenol in the presence of a first solid acid catalyst promoted with a thiol under conditions effective to produce a first effluent stream comprising bisphenol isomers, unreacted phenol, trisphenols, organic sulfides and water;

(b3) recovering bisphenol-A from the first effluent stream to leave a residual stream comprising a mixture of bisphenol isomers depleted in bisphenol-A, unreacted phenol, trisphenols, organic sulfides and water;

(c3) dividing the residual stream into a first portion and a second portion;

(d3) contacting the first portion of the residual stream with a second catalyst under conditions effective to isomerize bisphenol isomers to bisphenol-A and to produce a second effluent stream;

(e3) recycling at least part of the second effluent stream to the recovering step (a3) or step (b3);

(f3) contacting the second portion of the residual stream with a third catalyst under conditions sufficient to allow acid-catalyzed hydrolysis of organic sulfides in the second portion of the residual stream to the corresponding thiols and produce a third effluent stream; and

(g3) distilling the third effluent stream to recover distillate products comprising phenols and thiols and produce a bottoms product comprising bisphenol isomers and trisphenols, and having a lower content of organic sulfides than the residual stream.

22. The method of claim 21, which further comprises recycling at least part of the distillate products to the condensing step (a3).

23. The method of claim 21 or claim 22, in which the second catalyst comprises an acidic ion exchange resin.

24. The method of any one of claims 21 to 23, in which the second catalyst comprises an acidic sulfonated ion exchange resin with 2% - 6% crosslinking.

25. The method of any one of claims 21 to 24, in which the thiol promoter and the recovered thiol are alkanethiols.

26. The method of any one of claims 21 to 25, in which the contacting step (d3) is conducted at a temperature from about 60 to 100°C.

27. The method of any one of claims 21 to 26, in which the third catalyst comprises an acidic ion exchange resin.
28. The method of any one of claims 21 to 27, in which the third catalyst comprises an acidic sulfonated ion exchange resin with 2% - 6% crosslinking.
29. The method of any one of claims 21 to 28, in which the contacting step (f3) is conducted at a temperature from about 60 to 110°C.
30. The method of any one of claims 21 to 29, in which the residual stream in step (b3) comprises hydrolyzable organic sulfides in an amount up to 6,000 ppmwt and water present in a sufficient amount that the molar ratio of water to hydrolyzable organic sulfides is at least 4:1.
31. The method of any one of claims 21 to 30, in which the recovering step (b3) comprises crystallization and the residual stream comprises a mother liquor stream from the crystallization.