CLAIMS

We Claim:

1. A process for treating an ethylbenzene oxidate stream used for alkene oxide production, the process comprising:

providing an ethylbenzene oxidate stream comprising (i) an ethylbenzene hydroperoxide, (ii) at least one undesired compound, and (iii) an organic solvent;

contacting the ethylbenzene oxidate stream with an aqueous alkali solution to form a mixture, followed by separating the mixture into an aqueous phase and an organic phase, wherein the aqueous alkali solution comprises a metal hydroxide, the metal hydroxide is sodium hydroxide or potassium hydroxide; and

subjecting the organic phase to one or more washing and separating cycles, each cycle comprising washing the organic phase with water to form a subsequent mixture followed by separating the subsequent mixture into a subsequent aqueous phase and a subsequent organic phase, wherein at least one of the washing and separating cycles comprises washing the organic phase or any subsequent organic phase with water in the presence of carbon dioxide.

2. A process according the claim 1, wherein the one or more washing and separating cycles comprises at least two washing and separating cycles, and wherein the first washing and separating cycle comprises washing the organic phase with water in the absence of carbon dioxide.
3. A process according to claim 1, wherein the carbon dioxide is provided in the form of gaseous carbon dioxide, dry ice, carbonated water, or supercritical (liquid) carbon dioxide.
4. A process according to claim 1, wherein the ethylbenzene oxidate stream comprises ethylbenzene and cumene.
5. A process according to claim 1, wherein the aqueous alkali solution comprises the alkali metal hydroxide in a concentration of from about 0.01 wt. % to about 50 wt. %.
6. A process according to claim 1, wherein the metal hydroxide is sodium hydroxide.
7. A process according to claim 1, wherein the contacting step, the one or more washing and separating cycles, or both are conducted at a temperature of from about 10°C to about 150°C.
8. A process according to claim 1, wherein the concentration of alkali metal in the subsequent organic phase is less than the concentration of alkali metal in the subsequent

organic phase when the washing and separating cycles are performed in the absence of carbon dioxide.

9. A process according to claim 1, wherein the organic solvent comprises an aliphatic or an aromatic hydrocarbon solvent.

10. A process according to claim 1, wherein the concentration of the ethylbenzene hydroperoxide in the ethylbenzene oxidate stream is from about 1.0 wt. % to about 40 wt. %.

11. A process for the co-production of an alkene oxide and styrene monomer, the process comprising:

contacting molecular oxygen with ethylbenzene to form an oxidate stream comprising ethylbenzene hydroperoxide and at least one undesired compound;

contacting the oxidate stream with an aqueous alkali solution to form a mixture, followed by separating the mixture into an aqueous phase and an organic phase comprising ethylbenzene hydroperoxide, wherein the aqueous alkali solution comprises an alkali metal hydroxide and wherein the alkali metal hydroxide is sodium hydroxide or potassium hydroxide;

subjecting the organic phase to one or more washing and separating cycles, each cycle comprising washing the organic phase with water to form a subsequent mixture followed by separating the subsequent mixture into a subsequent aqueous phase and a subsequent organic phase comprising ethylbenzene hydroperoxide;

contacting the ethylbenzene hydroperoxide of the subsequent organic phase with an alkene in the presence of a catalyst to form a reaction mixture comprising an alkene oxide and 1-phenylethanol; and

dehydrating the 1-phenylethanol of the reaction mixture to provide styrene;

wherein at least one of the washing and separating cycles comprises washing the organic phase or any subsequent organic phase with water in the presence of carbon dioxide.

12. A process according to claim 11, wherein the one or more washing and separating cycles comprises at least two washing and separating cycles, and wherein the first washing and separating cycle comprises washing the organic phase with water in the absence of carbon dioxide.

13. A process according to claim 11, wherein the carbon dioxide is provided in the form of gaseous carbon dioxide, dry ice, carbonated water, or supercritical (liquid) carbon dioxide.

14. A process according to claim 11, wherein the alkene comprises ethylene, propylene, or butylene.

15. A process according to claim 11, wherein the aqueous alkali solution comprises the alkali metal hydroxide in a concentration of from about 0.01 wt. % to about 50 wt. %.

16. A process according to claim 11, wherein the contacting the oxidate stream with an aqueous alkali solution, the one or more washing and separating cycles, or both are conducted at a temperature of from about 10°C to about 150°C.

17. A process for removing sodium salts formed in the co-production of propylene oxide and styrene monomer, the process comprising:

providing an ethylbenzene oxidate stream comprising (i) ethylbenzene hydroperoxide, (ii) at least one undesired compound, and (iii) an organic solvent;

contacting the ethylbenzene oxidate stream with an aqueous sodium hydroxide solution to form a mixture, followed by separating the mixture into an aqueous phase and an organic phase;

subjecting the organic phase to one or more washing and separating cycles, each cycle comprising washing the organic phase with water to form a subsequent mixture followed by separating the subsequent mixture into a subsequent aqueous phase and a subsequent organic phase, wherein at least one of the washing and separating cycles comprises washing the organic phase or any subsequent organic phase with water in the presence of carbon dioxide; and

directing a portion of any subsequent organic phase to a reactor.

18. A process according to claim 17, wherein the one or more washing and separating cycles comprises at least two washing and separating cycles, and wherein the first washing and separating cycle comprises washing the organic phase with water in the absence of carbon dioxide.

19. A process according to claim 17, wherein the carbon dioxide is provided in the form of gaseous carbon dioxide, dry ice, carbonated water, or supercritical (liquid) carbon dioxide.

20. A process according to claim 17, wherein the aqueous sodium hydroxide solution comprises sodium hydroxide in a concentration of from about 0.01 wt. % to about 50 wt. %.