CLAIMS

What is claimed is:

1. A propylene oxide separation system comprising:

a distillation column configured to receive a crude propylene oxide stream, discharge an impurity stream comprising methanol and water, and discharge a bottoms stream comprising a majority of the propylene oxide entering in the crude propylene oxide stream;

a decanter configured to receive at least a portion of the impurity stream and a hydrocarbon solvent to provide for formation in the decanter of an organic phase comprising propylene oxide and hydrocarbon solvent, and an aqueous phase comprising a majority weight percent of the methanol and the water entering in the at least a portion of the impurity stream; and

a water wash system configured to receive and purge the aqueous phase from the propylene oxide separation system, wherein the organic phase in the decanter is sent to the distillation column.

2. The propylene oxide separation system of claim 1, wherein the crude propylene oxide stream is a propylene oxide reactor effluent stream in a propylene oxide/tert-Butanol process system.

3. The propylene oxide separation system of claim 1, wherein the distillation column includes an overhead condenser, and wherein the distillation column is configured with an overhead vapor purge of non-condensed components from the overhead condenser.

4. The propylene oxide separation system of claim 3, wherein the decanter is an overhead decanter to the distillation column, and is configured to receive at least a portion of the impurity stream from the overhead condenser.

5. The propylene oxide separation system of claim 1, wherein the decanter is a side decanter to the distillation column, and is configured to receive at least a portion of the impurity stream from a liquid side draw of the distillation column.

6. The propylene oxide separation system of claim 1, wherein the distillation column is a solvent-lights column, and wherein the water wash system comprises a static mixer and a coalescer.

7. The propylene oxide separation system of claim 1, further comprising a solvent stripper configured to receive the bottoms stream from the distillation column, wherein the solvent stripper is configured to discharge a solvent-stripper overhead stream comprising

a majority of the propylene oxide entering the solvent stripper in the bottoms stream from the distillation column.

8. The propylene oxide separation system of claim 7, wherein the solvent stripper is configured to discharge a solvent-stripper bottoms stream comprising at least a portion of the hydrocarbon solvent received at the decanter.

9. The propylene oxide separation system of claim 7, further comprising an extraction column configured to subject the solvent-stripper overhead stream from the solvent stripper to a hydrocarbon solvent extraction to remove impurities, wherein the extraction column is configured to purge the removed impurities comprising formaldehyde to the water wash system.

10. A method for separating propylene oxide from a crude propylene oxide stream in a separation system, the method comprising:

feeding the crude propylene oxide stream to a distillation column;

discharging an impurity stream from the distillation column to a decanter, the impurity stream comprising methanol and water;

feeding hydrocarbon solvent to the decanter;

forming in the decanter an organic phase comprising propylene oxide and hydrocarbon solvent, and an aqueous phase comprising a majority weight percent of the methanol and the water fed to the decanter in the impurity stream;

washing the aqueous phase with water and purging the washed aqueous phase from the separation system; and

sending the organic phase to the distillation column.

11. The method of claim 10, wherein discharging the impurity stream comprises discharging the impurity stream to the decanter via an overhead condenser of the distillation column, and the method further comprises purging a vapor stream from the overhead condenser.

12. The method of claim 10, wherein discharging the impurity stream comprises discharging the impurity stream to the decanter via a liquid side draw of the distillation column.

13. The method of claim 10, comprising:

discharging a bottoms stream from the distillation column, the bottoms stream comprising a majority of the propylene oxide entering the distillation column in the crude propylene oxide stream;

separating formaldehyde from the bottoms stream; and

sending the formaldehyde to a water wash system performing the washing of the aqueous phase with water.

14. A propylene oxide separation system comprising:

a distillation column configured to receive a processed crude propylene oxide stream, discharge an impurity stream comprising methanol and water, and discharge a bottoms stream comprising a majority of the propylene oxide entering in the processed crude propylene oxide stream;

a mixer configured to mix caustic with at least a portion of the impurity stream to give a caustic-treated impurity stream; and

a backwash column configured to subject the caustic-treated impurity stream to both an aqueous extraction and an organic extraction.

15. The propylene oxide separation system of claim 14, wherein the backwash column is configured to purge an aqueous stream comprising a majority amount of the methanol and the water in the caustic-treated impurity stream.

16. The propylene oxide separation system of claim 14, wherein the backwash column is configured to discharge an organic stream comprising hydrocarbon solvent and propylene oxide to the distillation column.

17. The propylene oxide separation system of claim 14, further comprising:

a lights distillation column configured to receive a crude propylene oxide stream, remove light components, and discharge a lights-distillation column bottoms stream comprising a majority of the propylene oxide from the crude propylene oxide stream; and

a heavies distillation column configured to receive the lights-distillation column bottoms stream, remove heavy components, and discharge an overhead stream comprising a majority of the propylene oxide from the lights-distillation column bottoms stream, and wherein the overhead stream comprises the processed crude propylene oxide stream.

18. The propylene oxide separation system of claim 14, further comprising:

a heavies distillation column configured to receive a crude propylene oxide stream, remove heavy components from the crude propylene oxide stream, and discharge an overhead stream comprising a majority of the propylene oxide from the crude propylene oxide stream; and

a lights distillation column configured to receive the overhead stream, remove heavy components from the overhead stream, and discharge a lights-distillation column bottoms stream comprising a majority of the propylene oxide from the overhead stream, and wherein the lights-distillation column bottoms stream comprises the processed crude propylene oxide stream.

19. The propylene oxide separation system of claim 14, further comprising an extraction column disposed downstream of the distillation column, and configured to purge formaldehyde to the mixer, wherein the formaldehyde is carryover from the bottoms stream of the distillation column.

20. The propylene oxide separation system of claim 14, wherein the caustic comprises sodium hydroxide.

CLAIMS

What is claimed is:

1. A propylene oxide separation system comprising:

a distillation column configured to receive a crude propylene oxide stream, discharge an impurity stream comprising methanol and water, and discharge a bottoms stream comprising a majority of the propylene oxide entering in the crude propylene oxide stream;

a decanter configured to receive at least a portion of the impurity stream and a hydrocarbon solvent to provide for formation in the decanter of an organic phase comprising propylene oxide and hydrocarbon solvent, and an aqueous phase comprising a majority weight percent of the methanol and the water entering in the at least a portion of the impurity stream; and

a water wash system configured to receive and purge the aqueous phase from the propylene oxide separation system, wherein the organic phase in the decanter is sent to the distillation column.

2. The propylene oxide separation system of claim 1, wherein the crude propylene oxide stream is a propylene oxide reactor effluent stream in a propylene oxide/tert-Butanol process system.

3. The propylene oxide separation system of claim 1, wherein the distillation column includes an overhead condenser, and wherein the distillation column is configured with an overhead vapor purge of non-condensed components from the overhead condenser.

4. The propylene oxide separation system of claim 3, wherein the decanter is an overhead decanter to the distillation column, and is configured to receive at least a portion of the impurity stream from the overhead condenser.

5. The propylene oxide separation system of claim 1, wherein the decanter is a side decanter to the distillation column, and is configured to receive at least a portion of the impurity stream from a liquid side draw of the distillation column.

6. The propylene oxide separation system of claim 1, wherein the distillation column is a solvent-lights column, and wherein the water wash system comprises a static mixer and a coalescer.

7. The propylene oxide separation system of claim 1, further comprising a solvent stripper configured to receive the bottoms stream from the distillation column, wherein the solvent stripper is configured to discharge a solvent-stripper overhead stream comprising a majority of the propylene oxide entering the solvent stripper in the bottoms stream from the distillation column.

8. The propylene oxide separation system of claim 7, wherein the solvent stripper is configured to discharge a solvent-stripper bottoms stream comprising at least a portion of the hydrocarbon solvent received at the decanter.

9. The propylene oxide separation system of claim 7, further comprising an extraction column configured to subject the solvent-stripper overhead stream from the solvent stripper to a hydrocarbon solvent extraction to remove impurities, wherein the extraction column is configured to purge the removed impurities comprising formaldehyde to the water wash system.

10. A method for separating propylene oxide from a crude propylene oxide stream in a separation system, the method comprising:

feeding the crude propylene oxide stream to a distillation column;

discharging an impurity stream from the distillation column to a decanter, the impurity stream comprising methanol and water;

feeding hydrocarbon solvent to the decanter;

forming in the decanter an organic phase comprising propylene oxide and hydrocarbon solvent, and an aqueous phase comprising a majority weight percent of the methanol and the water fed to the decanter in the impurity stream;

washing the aqueous phase with water and purging the washed aqueous phase from the separation system; and

sending the organic phase to the distillation column;

wherein discharging the impurity stream optionally comprises discharging the impurity stream to the decanter via an overhead condenser of the distillation column, and the method further comprises purging a vapor stream from the overhead condenser.

11. The method of claim 10, wherein discharging the impurity stream comprises discharging the impurity stream to the decanter via a liquid side draw of the distillation column.

12. The method of claim 10, comprising:

discharging a bottoms stream from the distillation column, the bottoms stream comprising a majority of the propylene oxide entering the distillation column in the crude propylene oxide stream;

separating formaldehyde from the bottoms stream; and

sending the formaldehyde to a water wash system performing the washing of the aqueous phase with water.

13. A propylene oxide separation system comprising:

a distillation column configured to receive a processed crude propylene oxide stream, discharge an impurity stream comprising methanol and water, and discharge a bottoms stream comprising a majority of the propylene oxide entering in the processed crude propylene oxide stream;

a mixer configured to mix caustic with at least a portion of the impurity stream to give a caustic-treated impurity stream; and

a backwash column configured to subject the caustic-treated impurity stream to both an aqueous extraction and an organic extraction;

wherein the caustic optionally comprises sodium hydroxide; and

wherein the backwash column is optionally configured to purge an aqueous stream comprising a majority amount of the methanol and the water in the caustic-treated impurity stream and to discharge an organic stream comprising hydrocarbon solvent and propylene oxide to the distillation column.

14. The propylene oxide separation system of claim 13, further comprising:

a lights distillation column configured to receive a crude propylene oxide stream, remove light components, and discharge a lights-distillation column bottoms stream comprising a majority of the propylene oxide from the crude propylene oxide stream; and

a heavies distillation column configured to receive the lights-distillation column bottoms stream, remove heavy components, and discharge an overhead stream comprising a majority of the propylene oxide from the lights-distillation column bottoms stream, and wherein the overhead stream comprises the processed crude propylene oxide stream.

15. The propylene oxide separation system of claim 13, further comprising:

a heavies distillation column configured to receive a crude propylene oxide stream, remove heavy components from the crude propylene oxide stream, and discharge an overhead stream comprising a majority of the propylene oxide from the crude propylene oxide stream;

a lights distillation column configured to receive the overhead stream, remove heavy components from the overhead stream, and discharge a lights-distillation column bottoms stream comprising a majority of the propylene oxide from the overhead stream, and wherein the lights-distillation column bottoms stream comprises the processed crude propylene oxide stream; and

an extraction column disposed downstream of the distillation column, and configured to purge formaldehyde to the mixer, wherein the formaldehyde is carryover from the bottoms stream of the distillation column.