CLAIMS

We claim:

1. A method for recovering one or more chemicals, the method comprising:

providing at least one stream from a process for co-producing propylene oxide and styrene monomer;

disposing the at least one stream in a settling tank to separate the at least one stream into an aqueous stream and an organic stream, wherein the aqueous stream comprises (i) mono-propylene glycol, and (ii) a first amount of α-methyl benzyl alcohol, a first amount of benzaldehyde, a first amount of acetophenone, or a combination thereof;

contacting the aqueous stream with an organic extraction liquid in a liquid-liquid extraction unit to form a first aqueous extraction stream and a first organic extraction stream; and

disposing the first aqueous extraction stream in a coalescer;

wherein the first aqueous extraction stream comprises (i) mono-propylene glycol, and (ii) a second amount of α-methyl benzyl alcohol, a second amount of benzaldehyde, a second amount of acetophenone, or a combination thereof; and

wherein the second amount of α-methyl benzyl alcohol, the second amount of benzaldehyde, and the second amount of acetophenone are less than the first amount of α-methyl benzyl alcohol, the first amount of benzaldehyde, and the first amount of acetophenone, respectively.

2. The method of claim 1, further comprising contacting the first aqueous extraction stream with an additional amount of the organic extraction liquid to form a second aqueous extraction stream and a second organic extraction stream; wherein the second aqueous extraction stream comprises (i) mono-propylene glycol, and (ii) a third amount of α-methyl benzyl alcohol, a third amount of benzaldehyde, a third amount of acetophenone, or a combination thereof, and the third amount of α-methyl benzyl alcohol, the third amount of

benzaldehyde, and the third amount of acetophenone are less than the second amount of α-methyl benzyl alcohol, the second amount of benzaldehyde, and the second amount of acetophenone, respectively.

3. The method of claim 1, further comprising contacting the first aqueous extraction stream with activated carbon.

4. The method of claim 1, further comprising disposing the first aqueous extraction stream in an apparatus configured to isolate mono-propylene glycol from the first aqueous extraction stream.

5. The method of claim 1, wherein the aqueous stream and the organic extraction liquid are present in the liquid-liquid extraction unit at a weight ratio of about 0.5:1 to about 1:0.5 (aqueous stream:organic extraction liquid).

6. The method of claim 1, further comprising distilling at least one of the organic stream or the first organic extraction stream.

7. The method of claim 6, wherein the distilling of at least one of the organic stream or the first organic extraction stream comprises separating from at least one of the organic stream or the first organic extraction stream (i) a first distilled stream comprising ethyl benzene, styrene, or a combination thereof, (ii) a second distilled stream comprising benzaldehyde, (iii) a third distilled stream comprising α-methyl benzyl alcohol, acetophenone, or a combination thereof, or (iv) a combination thereof.

8. The method of claim 7, further comprising (i) disposing the first distilled stream in the liquid-liquid extraction unit, (ii) recycling the first distilled stream to the process for co-producing propylene oxide and styrene monomer, or (iii) a combination thereof.

9. The method of claim 7, further comprising recycling the third distilled stream to the process for co-producing propylene oxide and styrene monomer.

10. The method of claim 1, wherein the liquid-liquid extraction unit comprises a mixing-separating vessel, a liquid-liquid extraction column, a mixer-coalescer device, or a combination thereof.

11. The method of claim 1, wherein the organic extraction liquid comprises ethyl benzene, *n*-octane, toluene, or a combination thereof.

12. The method of claim 1, further comprising separating mono-propylene glycol, benzaldehyde, α-methyl benzyl alcohol, acetophenone, or a combination thereof from the first aqueous extraction stream, the first organic extraction stream, or a combination thereof.

13. A method for recovering one or more chemicals, the method comprising:

providing at least one stream from a process for co-producing propylene oxide and styrene monomer;

disposing the at least one stream in a settling tank to separate the at least one stream into an aqueous stream and an organic stream, wherein the aqueous stream comprises (i) mono-propylene glycol, and (ii) a first amount of α-methyl benzyl alcohol, a first amount of benzaldehyde, a first amount of acetophenone, or a combination thereof; and

contacting the aqueous stream with an organic extraction liquid in a liquid-liquid extraction unit to form a first aqueous extraction stream and a first organic extraction stream; and

contacting the first aqueous extraction stream with activated carbon;

wherein the first aqueous extraction stream comprises (i) mono-propylene glycol, and (ii) a second amount of α-methyl benzyl alcohol, a second amount of benzaldehyde, a second amount of acetophenone, or a combination thereof; and

wherein the second amount of α-methyl benzyl alcohol, the second amount of benzaldehyde, and the second amount of acetophenone are less than the first amount of α-methyl benzyl alcohol, the first amount of benzaldehyde, and the first amount of acetophenone, respectively.

14. The method of claim 13, wherein the aqueous stream and the organic extraction liquid are present in the liquid-liquid extraction unit at a weight ratio of about 0.5:1 to about 1:0.5 (aqueous stream:organic extraction liquid).

15. The method of claim 13, further comprising distilling at least one of the organic stream or the first organic extraction stream.

16. The method of claim 15, wherein the distilling of at least one of the organic stream or the first organic extraction stream comprises separating from at least one of the organic stream or the first organic extraction stream (i) a first distilled stream comprising ethyl benzene, styrene, or a combination thereof, (ii) a second distilled stream comprising benzaldehyde, (iii) a third distilled stream comprising α-methyl benzyl alcohol, acetophenone, or a combination thereof, or (iv) a combination thereof.

17. The method of claim 16, further comprising (i) disposing the first distilled stream in the liquid-liquid extraction unit, (ii) recycling the first distilled stream to the process for co-producing propylene oxide and styrene monomer, or (iii) a combination thereof.

18. A method for recovering one or more chemicals, the method comprising:

providing at least one stream from a process for co-producing propylene oxide and styrene monomer;

disposing the at least one stream in a settling tank to separate the at least one stream into an aqueous stream and an organic stream, wherein the aqueous stream comprises (i) mono-propylene glycol, and (ii) a first amount of α-methyl benzyl alcohol, a first amount of benzaldehyde, a first amount of acetophenone, or a combination thereof; and

contacting the aqueous stream with an organic extraction liquid in a liquid-liquid extraction unit to form a first aqueous extraction stream and a first organic extraction stream; and

disposing the first aqueous extraction stream in an apparatus configured to isolate mono-propylene glycol from the first aqueous extraction stream;

wherein the first aqueous extraction stream comprises (i) mono-propylene glycol, and (ii) a second amount of α-methyl benzyl alcohol, a second amount of benzaldehyde, a second amount of acetophenone, or a combination thereof; and

wherein the second amount of α-methyl benzyl alcohol, the second amount of benzaldehyde, and the second amount of acetophenone are less than the first amount of α-methyl benzyl alcohol, the first amount of benzaldehyde, and the first amount of acetophenone, respectively.

19. The method of claim 18, wherein the aqueous stream and the organic extraction liquid are present in the liquid-liquid extraction unit at a weight ratio of about 0.5:1 to about 1:0.5 (aqueous stream:organic extraction liquid).

20. The method of claim 18, further comprising distilling at least one of the organic stream or the first organic extraction stream.

21. The method of claim 20, wherein the distilling of at least one of the organic stream or the first organic extraction stream comprises separating from at least one of the organic stream or the first organic extraction stream (i) a first distilled stream comprising ethyl benzene, styrene, or a combination thereof, (ii) a second distilled stream comprising benzaldehyde, (iii) a third distilled stream comprising α-methyl benzyl alcohol, acetophenone, or a combination thereof, or (iv) a combination thereof.

22. The method of claim 21, further comprising (i) disposing the first distilled stream in the liquid-liquid extraction unit, (ii) recycling the first distilled stream to the process for co-producing propylene oxide and styrene monomer, or (iii) a combination thereof.