The invention claimed is:

1. A process for recovering ethanol, comprising:

hydrogenating acetic acid in an acetic acid feed stream in the presence of a catalyst to form a crude product;

separating at least a portion of the crude product into an intermediate stream comprising one or more C_2+ alcohols, and a residue comprising acetic acid; and

separating at least a portion of the intermediate stream in a column into a product distillate comprising ethanol, and one or more sidedraws comprising one or more C_3+ alcohols.

2. The process of claim 1, wherein said one or more C_2+ alcohols are selected from the group consisting of ethanol, isopropanol, n-propanol, n-butanol, 2-butanol, isobutanol, tert-butanol, 2,2-dimethyl-1-propanol, 3-pentanol, 2-pentanol, 1-pentanol, 3-methyl-2-butanol, 2-methyl-2-butanol, a mixture thereof, and an azeotrope thereof.

3. The process of claim 1, wherein said one or more sidedraws comprise one or more C_3 to C_6 alcohols, a mixture thereof, and an azeotrope thereof.

4. The process of claim 1, wherein said one or more C_3+ alcohols are selected from the group consisting of isopropanol, n-propanol, n-butanol, 2-butanol, isobutanol, tert-butanol, 2,2-dimethyl-1-propanol, 3-pentanol, 2-pentanol, 1-pentanol, 3-methyl-2-butanol, 2-methyl-2-butanol, a mixture thereof, and an azeotrope thereof.

5. The process of claim 1, wherein said intermediate stream comprises said one or more C_2+ alcohols in an amount from 20 to 95 wt.% and, wherein said one or more C_2+ alcohols comprises from 90 to 99.9 wt.% ethanol and from 0.001 to 10 wt.% of said one or more C_3+ alcohols.

6. The process of claim 1, wherein said intermediate stream comprises said one or more C_2+ alcohols in an amount from 20 to 95 wt.% and, wherein said one or more C_2+ alcohols comprises from 90 to 99.9 wt.% ethanol and from 0.001 to 10 wt.% of said one or more C_3+ alcohols.

7. The process of claim 1, wherein said one or more sidedraws are in the liquid phase.

8. The process of claim 1, wherein said one or more sidedraws are in the vapor phase.

9. The process of claim 1, wherein the product distillate comprises substantially none of said one or more C_3+ alcohols.

10. The process of claim 1, wherein the product distillate comprises less than 1000 wppm of said one of more C_3+ alcohols.

11. The process of claim 1, further comprising removing a residue comprising water from the at least a portion of the intermediate stream.

12. The process of claim 11, wherein the residue comprises less than 1000 wppm of said one of more C_3+ alcohols.

13. The process of claim 1, further comprising measuring C_3+ alcohols concentration in the product distillate and withdrawing said one or more sidedraws when the measured C_3+ alcohols concentration exceeds a target level.

14. The process of claim 1, wherein the acetic acid feed stream comprises propanoic acid.

15. The process of claim 1, wherein the catalyst comprises a combination of metals selected from the group consisting of platinum/tin, platinum/ruthenium, platinum/rhenium, palladium/ruthenium, palladium/rhenium, cobalt/palladium, cobalt/platinum, cobalt/chromium, cobalt/ruthenium, silver/palladium, copper/palladium, nickel/palladium, gold/palladium, ruthenium/rhenium, and ruthenium/iron.

16. The process of claim 1, further comprising wherein the acetic acid is formed from methanol and carbon monoxide, wherein each of the methanol, the carbon monoxide, and hydrogen for the hydrogenating step is derived from syngas, and wherein the syngas is derived

from a carbon source selected from the group consisting of natural gas, oil, petroleum, coal, biomass, and combinations thereof.

17. A process for recovering ethanol, comprising:

hydrogenating acetic acid in an acetic acid feed stream in the presence of a catalyst to form a crude product;

separating at least a portion of the crude product in a first column into a first distillate comprising one or more C_2+ alcohols and ethyl acetate, and a first residue comprising acetic acid;

separating at least a portion of the first distillate in a second column into a second distillate comprising ethyl acetate and a second residue comprising one or more C_2+ alcohols; and

separating at least a portion of the second residue in a third column into a third distillate comprising ethanol, and one or more sidedraws comprising one or more C_3+ alcohols.

18. The process of claim 17, wherein said one or more C_3+ alcohols are selected from the group consisting of isopropanol, n-propanol, n-butanol, 2-butanol, isobutanol, tert-butanol, 2,2-dimethyl-1-propanol, 3-pentanol, 2-pentanol, 1-pentanol, 3-methyl-2-butanol, 2-methyl-2-butanol, a mixture thereof, and an azeotrope thereof.

19. The process of claim 17, wherein said first distillate comprises said one or more C_2+ alcohols in an amount from 20 to 95 wt.% and, wherein said one or more C_2+ alcohols comprises from 90 to 99.9 wt.% ethanol and from 0.001 to 10 wt.% of said one or more C_3+ alcohols.

20. The process of claim 17, wherein said first distillate comprises said one or more C_2+ alcohols in an amount from 20 to 95 wt.% and, wherein said one or more C_2+ alcohols comprises from 90 to 99.9 wt.% ethanol and from 0.001 to 10 wt.% of said one or more C_3+ alcohols.

21. The process of claim 17, wherein said second residue comprising said one or more C_2+ alcohols comprises from 0.001 to 10 wt.% of said one or more C_3+ alcohols.

22. The process of claim 17, wherein the third distillate comprises less than 1000 wppm of said one of more C_3+ alcohols.

23. A process for recovering ethanol, comprising:

providing a crude product comprising ethanol, acetic acid, water, and one or more C_3+ alcohols, wherein the concentration of the one or more C_3+ alcohols is less than 8 wt.%;

separating at least a portion of the crude product into an intermediate stream comprising ethanol and one or more C_3+ alcohols, and a residue comprising acetic acid; and

separating at least a portion of the intermediate stream in a column into a product distillate comprising ethanol, one or more sidedraws comprising one or more C_3+ alcohols, and a residue comprising water.

The invention claimed is

1. A process for recovering ethanol, comprising:

hydrogenating acetic acid in an acetic acid feed stream in the presence of a catalyst to form a crude product;

separating at least a portion of the crude product into an intermediate stream comprising one or more C_{2+} alcohols, and a residue comprising acetic acid; and

separating at least a portion of the intermediate stream in a column into a product distillate comprising ethanol, and one or more sidedraws comprising one or more C_{3+} alcohols.

2. The process of claim 1, wherein said one or more C_{2+} alcohols are selected from the group consisting of ethanol, isopropanol, n-propanol, n-butanol, 2-butanol, isobutanol, tert-butanol, 2,2-dimethyl-1-propanol, 3-pentanol, 2-pentanol, 1-pentanol, 3-methyl-2-butanol, 2-methyl-2-butanol, a mixture thereof, and an azeotrope thereof.

3. The process of claim 1, wherein said one or more sidedraws comprise one or more C_3 to C_6 alcohols, a mixture thereof, and an azeotrope thereof.

4. The process of claim 1, wherein said one or more C_{3+} alcohols are selected from the group consisting of isopropanol, n-propanol, n-butanol, 2-butanol, isobutanol, tert-butanol, 2,2-dimethyl-1-propanol, 3-pentanol, 2-pentanol, 1-pentanol, 3-methyl-2-butanol, 2-methyl-2-butanol, a mixture thereof, and an azeotrope thereof.

5. The process of claim 1, wherein said intermediate stream comprises said one or more C_{2+} alcohols in an amount from 20 to 95 wt.% and, wherein said one or more C_{2+} alcohols comprises from 90 to 99.9 wt.% ethanol and from 0.001 to 10 wt.% of said one or more C_{3+} alcohols.

6. The process of claim 1, wherein said intermediate stream comprises said one or more C_{2+} alcohols in an amount from 20 to 95 wt.% and, wherein said one or more C_{2+} alcohols comprises from 90 to 99.9 wt.% ethanol and from 0.001 to 10 wt.% of said one or more C_{3+} alcohols.

7. The process of claim 1, wherein said one or more sidedraws are in the liquid phase.

8. The process of claim 1, wherein said one or more sidedraws are in the vapor phase.

9. The process of claim 1, wherein the product distillate comprises substantially none of said one or more C_{3+} alcohols.

10. The process of claim 1, wherein the product distillate comprises less than 1000 wppm of said one of more C_{3+} alcohols.

11. The process of claim 1, further comprising removing a residue comprising water from the at least a portion of the intermediate stream.

12. The process of claim 11, wherein the residue comprises less than 1000 wppm of said one of more C_{3+} alcohols.

13. The process of claim 1, further comprising measuring C_{3+} alcohols concentration in the product distillate and withdrawing said one or more sidedraws when the measured C_{3+} alcohols concentration exceeds a target level.

14. The process of claim 1, wherein the acetic acid feed stream comprises propanoic acid.

15. The process of claim 1, wherein the catalyst comprises a combination of metals selected from the group consisting of platinum/tin, platinum/ruthenium, platinum/rhenium, palladium/ruthenium, palladium/rhenium, cobalt/palladium, cobalt/platinum, cobalt/chromium, cobalt/ruthenium, silver/palladium, copper/palladium, nickel/palladium, gold/palladium, ruthenium/rhenium, and ruthenium/iron.

16. The process of claim 1, further comprising wherein the acetic acid is formed from methanol and carbon monoxide, wherein each of the methanol, the carbon monoxide, and hydrogen for the hydrogenating step is derived from syngas, and wherein the syngas is derived from a carbon source selected from the group consisting of natural gas, oil, petroleum, coal, biomass, and combinations thereof.

17. A process for recovering ethanol, comprising:

hydrogenating acetic acid in an acetic acid feed stream in the presence of a catalyst to form a crude product;

separating at least a portion of the crude product in a first column into a first distillate comprising one or more C_{2+} alcohols and ethyl acetate, and a first residue comprising acetic acid;

separating at least a portion of the first distillate in a second column into a second distillate comprising ethyl acetate and a second residue comprising one or more C_{2+} alcohols; and

separating at least a portion of the second residue in a third column into a third distillate comprising ethanol, and one or more sidedraws comprising one or more C_{3+} alcohols.

18. The process of claim 17, wherein said one or more C_{3+} alcohols are selected from the group consisting of isopropanol, n-propanol, n-butanol, 2-butanol, isobutanol, tert-butanol, 2,2-dimethyl-1-propanol, 3-pentanol, 2-pentanol, 1-pentanol, 3-methyl-2-butanol, 2-methyl-2-butanol, a mixture thereof, and an azeotrope thereof.

19. The process of claim 17, wherein said first distillate comprises said one or more C_{2+} alcohols in an amount from 20 to 95 wt.% and, wherein said one or more C_{2+} alcohols comprises from 90 to 99.9 wt.% ethanol and from 0.001 to 10 wt.% of said one or more C_{3+} alcohols.

20. The process of claim 17, wherein said first distillate comprises said one or more C_{2+} alcohols in an amount from 20 to 95 wt.% and, wherein said one or more C_{2+} alcohols comprises from 90 to 99.9 wt.% ethanol and from 0.001 to 10 wt.% of said one or more C_{3+} alcohols.

21. The process of claim 17, wherein said second residue comprising said one or more C_{2+} alcohols comprises from 0.001 to 10 wt.% of said one or more C_{3+} alcohols.

22. The process of claim 17, wherein the third distillate comprises less than 1000 wppm of said one of more C_{3+} alcohols.

23. A process for recovering ethanol, comprising:

providing a crude product comprising ethanol, acetic acid, water, and one or more C_{3+} alcohols, wherein the concentration of the one or more C_{3+} alcohols is less than 8 wt.%;

separating at least a portion of the crude product into an intermediate stream comprising ethanol and one or more C_{3+} alcohols, and a residue comprising acetic acid; and

separating at least a portion of the intermediate stream in a column into a product distillate comprising ethanol, one or more sidedraws comprising one or more C_{3+} alcohols, and a residue comprising water.