We claim:

1. A process for purifying a crude ethanol product, the process comprising the steps of:

hydrogenating acetic acid in the presence of a catalyst in a reactor to form a crude ethanol product comprising ethanol, water, ethyl acetate and acetal, wherein the acetal is present in a first amount; and

separating at least a portion of the crude ethanol product in a first column into a first distillate comprising ethanol, water, ethyl acetate and a second amount of acetal, and a first residue comprising acetic acid, wherein the first amount is greater than the second amount.

2. The process of claim 1, wherein the first amount is at least 50% greater than the second amount.

3. The process as in any one of claims 1 and 2, wherein the first amount of acetal is greater than 0.0005 wt.%, based on the total weight of the at least a portion of the crude ethanol product.

4. The process as in one of claims 1-3, wherein the second amount of acetal is less than 5 wt.%, based on the total weight of the at least a portion of the crude ethanol product.

5. The process as in one of claims 1-4, wherein the acetal is selected from the group consisting of diethyl acetal, ethyl propyl acetal, ethyl butyl acetal and hemiacetals thereof.

6. The process as in one of claims 1-5, wherein the first residue comprises substantially no acetal.

7. The process as in one of claims 1-6, further comprising the steps of:

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 ethanol and water; and

separating at least a portion of the second residue in a third column into a third distillate comprising ethanol and a third residue comprising water.

8. The process of claim 7, wherein acetal present in the at least a portion of the first distillate fed to the second column is hydrolyzed in the second column.

9. The process as in any one of claims 7 and 8, wherein the third distillate comprises substantially no acetal.

10. The process as in one of claims 1-9, wherein the catalyst comprises a combination 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.

11. A process for purifying a crude ethanol product, the process comprising the steps of:

hydrogenating acetic acid in a reactor in the presence of a catalyst to form a crude ethanol product comprising ethanol, ethyl acetate, water, acetic acid, and acetal;

separating at least a portion of the crude ethanol product in a first column into a first distillate comprising ethanol, water, ethyl acetate and acetal, and a first residue comprising acetic acid; and

hydrolyzing at least a portion of the first distillate.

12. The process of claim 11, wherein acetal in the at least a portion of the first distillate is hydrolyzed to produce ethanol and acetaldehyde.

13. The process as in any one of claims 11 and 12, wherein the acetal is selected from the group consisting of diethyl acetal, ethyl propyl acetal, ethyl butyl acetal and hemiacetals thereof.

14. The process as in one of claims 11-13, wherein the at least a portion of the first distillate is hydrolyzed in an ion exchange resin reactor bed.

15. The process of claim 14, wherein the ion exchange resin reactor bed is external to the first column.

16. The process as in any one of claims 14 and 15, further comprising the steps of:

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 ethanol and water; and

separating at least a portion of the second residue in a third column into a third distillate comprising ethanol and a third residue comprising water.

17. The process of claim 16, wherein at least a portion of the first distillate is hydrolyzed in the second column.

18. The process of claim 14, wherein the ion exchange resin reactor bed is located within the second column.

19. The process of claim 18, further comprising separating at least a portion of the second distillate in a fourth column into a fourth distillate comprising acetaldehyde and a fourth residue comprising ethyl acetate, wherein at least a portion of the fourth distillate is directly or indirectly returned to the reactor.

20. The process as in any one of claims 18 and 19, wherein the hydrolyzed portion of the first distillate is introduced to the fourth column.

21. A process for purifying a crude ethanol product, the process comprising the steps of:

hydrogenating acetic acid in a reactor in the presence of a catalyst to form a crude ethanol product comprising ethanol, ethyl acetate, water, acetic acid, and acetal;

hydrolyzing at least a portion of the crude ethanol product to form a hydrolyzed product; and

separating at least a portion of the hydrolyzed product in a first column into a first distillate comprising ethanol, water, ethyl acetate and acetal, and a first residue comprising acetic acid.

22. The process of claim 21, wherein the at least a portion of the crude ethanol product is hydrolyzed in an ion exchange resin reactor bed.

23. The process of claim 22, wherein the ion exchange resin reactor bed is located within the first column.

24. The process as in one of claims 21-23, wherein the acetal is selected from the group consisting of diethyl acetal, ethyl propyl acetal, ethyl butyl acetal and hemiacetals thereof.

25. The process as in one of claims 21-24, further comprising the steps of:
separating the crude ethanol product in a flasher into a vapor stream and a liquid stream,
returning at least a portion of the vapor stream to the reactor; and
hydrolyzing at least a portion of the liquid stream to form the hydrolyzed product.

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1. – 10. (Delete)

11. (Amended) A process for purifying a crude ethanol product, the process comprising the steps of:

hydrogenating acetic acid in a reactor in the presence of a catalyst to form a crude ethanol product comprising ethanol, ethyl acetate, water, acetic acid, and acetal;

separating at least a portion of the crude ethanol product in a first column into a first distillate comprising ethanol, water, ethyl acetate and acetal, and a first residue comprising acetic acid; and

hydrolyzing at least a portion of the first distillate in an ion exchange resin reactor bed.

12. The process of claim 11, wherein acetal in the at least a portion of the first distillate is hydrolyzed to produce ethanol and acetaldehyde.

13. The process as in any one of claims 11 and 12, wherein the acetal is selected from the group consisting of diethyl acetal, ethyl propyl acetal, ethyl butyl acetal and hemiacetals thereof.

14. (Deleted)

15. (Amended) The process of claim 11, wherein the ion exchange resin reactor bed is external to the first column.

16. (Amended) The process as in any one of claims 11 and 15, further comprising the steps of:

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 ethanol and water; and

separating at least a portion of the second residue in a third column into a third distillate comprising ethanol and a third residue comprising water.

17. The process of claim 16, wherein at least a portion of the first distillate is hydrolyzed in the second column.

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18. (Amended) The process of claim 11, wherein the ion exchange resin reactor bed is located within the second column.

19. The process of claim 18, further comprising separating at least a portion of the second distillate in a fourth column into a fourth distillate comprising acetaldehyde and a fourth residue comprising ethyl acetate, wherein at least a portion of the fourth distillate is directly or indirectly returned to the reactor.

20. The process as in any one of claims 18 and 19, wherein the hydrolyzed portion of the first distillate is introduced to the fourth column.

21. (Amended) A process for purifying a crude ethanol product, the process comprising the steps of:

hydrogenating acetic acid in a reactor in the presence of a catalyst to form a crude ethanol product comprising ethanol, ethyl acetate, water, acetic acid, and acetal;

hydrolyzing at least a portion of the crude ethanol product in an ion exchange resin reactor bed to form a hydrolyzed product; and

separating at least a portion of the hydrolyzed product in a first column into a first distillate comprising ethanol, water, ethyl acetate and acetal, and a first residue comprising acetic acid.

22. (Deleted)

23. (Amended) The process of claim 21, wherein the ion exchange resin reactor bed is located within the first column.

24. (Amended) The process as in one of claims 21 and 23, wherein the acetal is selected from the group consisting of diethyl acetal, ethyl propyl acetal, ethyl butyl acetal and hemiacetals thereof.

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25. (Amended) The process as in any one of claims 21-24, further comprising the steps of:

separating the crude ethanol product in a flasher into a vapor stream and a liquid stream,

returning at least a portion of the vapor stream to the reactor; and

hydrolyzing at least a portion of the liquid stream to form the hydrolyzed product.

26. (New) The process as in any one of claims 11-25, wherein the catalyst comprises a combination 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.

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We claim:

1. A process for purifying a crude ethanol product, the process comprising the steps of:

hydrogenating acetic acid in the presence of a catalyst in a reactor to form a crude ethanol product comprising ethanol, water, ethyl acetate and acetal, wherein the acetal is present in a first amount which is greater than 0.0005 wt. % based on the total weight of the crude ethanol product; and

separating at least a portion of the crude ethanol product in a first column into a first distillate comprising ethanol, water, ethyl acetate and a second amount of acetal which is less than 5 wt. %, based on the total weight of the first distillate, and a first residue comprising acetic acid, wherein the first amount is greater than the second amount.

2. The process of claim 1, wherein the first amount is at least 50% greater than the second amount.

3. The process of claim 1, wherein the acetal is selected from the group consisting of diethyl acetal, ethyl propyl acetal, ethyl butyl acetal and hemiacetals thereof.

4. The process of claim 1, wherein the first residue comprises substantially no acetal.

5. The process of claim 1, further comprising the steps of:

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 ethanol and water; and

separating at least a portion of the second residue in a third column into a third distillate comprising ethanol and a third residue comprising water.

6. The process of claim 5, wherein acetal present in the at least a portion of the first distillate fed to the second column is hydrolyzed in the second column.

7. The process of claim 5, wherein the third distillate comprises substantially no acetal.

8. The process of claim 1, wherein the catalyst comprises a combination 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.

9. A process for purifying a crude ethanol product, the process comprising the steps of:

hydrogenating acetic acid in a reactor in the presence of a catalyst to form a crude ethanol product comprising ethanol, ethyl acetate, water, acetic acid, and greater than 0.0005 wt. % acetal based on the total weight of the crude ethanol product;

separating at least a portion of the crude ethanol product in a first column into a first distillate comprising ethanol, water, ethyl acetate and acetal, and a first residue comprising acetic acid; and

hydrolyzing at least of portion of the first distillate.

10. The process of claim 9, wherein acetal in the at least of portion of the first distillate is hydrolyzed to produce ethanol and acetaldehyde.

11. The process of claim 9, wherein the acetal is selected from the group consisting of diethyl acetal, ethyl propyl acetal, ethyl butyl acetal and hemiacetals thereof.

12. The process of claim 9, wherein the at least a portion of the first distillate is hydrolyzed in an ion exchange resin reactor bed.

13. The process of claim 12, wherein the ion exchange resin reactor bed is external to the first column.

14. The process of claim 12, further comprising the steps of:

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 ethanol and water; and

separating at least a portion of the second residue in a third column into a third distillate comprising ethanol and a third residue comprising water.

15. The process of claim 14, wherein at least a portion of the first distillate is hydrolyzed in the second column.

16. The process of claim 15, wherein the ion exchange resin reactor bed is located within the second column.

17. The process of claim 14, further comprising separating at least a portion of the second distillate in a fourth column into a fourth distillate comprising acetaldehyde and a fourth residue comprising ethyl acetate, wherein at least a portion of the fourth distillate is directly or indirectly returned to the reactor.

18. The process of claim **17**, wherein the hydrolyzed portion of the first distillate is introduced to the fourth column.

19. A process for purifying a crude ethanol product, the process comprising the steps of:

hydrogenating acetic acid in a reactor in the presence of a catalyst to form a crude ethanol product comprising ethanol, ethyl acetate, water, acetic acid, and greater than 0.0005 wt. % acetal based on the total weight of the crude ethanol product;

hydrolyzing at least of portion of the crude ethanol product to form a hydrolyzed product; and

separating at least a portion of the hydrolyzed product in a first column into a first distillate comprising ethanol, water, ethyl acetate and less than 5 wt. % acetal based on the total weight of the first distillate, and a first residue comprising acetic acid.

20. The process of claim **19**, wherein the at least of portion of the crude ethanol product is hydrolyzed in an ion exchange resin reactor bed.

21. The process of claim **20**, wherein the ion exchange resin reactor bed is located within the first column.

22. The process of claim **19**, wherein the acetal is selected from the group consisting of diethyl acetal, ethyl propyl acetal, ethyl butyl acetal and hemiacetals thereof.

23. The process of claim **19**, further comprising the steps of:

separating the crude ethanol product in a flasher into a vapor stream and a liquid stream,

returning at least a portion of the vapor stream to the reactor; and hydrolyzing at least of portion of the liquid stream to form the hydrolyzed product.

24. A process for purifying a crude ethanol product, the process comprising the steps of:

providing a crude ethanol product comprising ethanol, water, ethyl acetate and acetal, wherein the acetal is present in a first amount which is greater than 0.0005 wt. % based on the total weight of the crude ethanol product; and

separating at least a portion of the crude ethanol product in a first column into a first distillate comprising ethanol, water, ethyl acetate and a second amount of acetal which is less than 5 wt. %, based on the total weight of the first distillate, and a first residue comprising acetic acid, wherein the first amount is greater than the second amount.