We claim:

1. A process for removing permanganate reducing compounds (PRC's) from a crude acetic acid composition, the process comprising the steps of:

separating the crude acetic acid composition in a light ends column into an overhead vapor stream comprising halogen promoter, water, acetic acid, methyl acetate, methanol, dimethyl ether, and at least one PRC, and an acetic acid product stream;

condensing and biphasically separating the overhead vapor stream into a heavy phase and a light phase;

extracting the light phase to obtain an aqueous stream comprising methyl acetate and at least one PRC, and a raffinate comprising halogen promoter, and methyl acetate; and

separating the aqueous stream in a distillation column into an overhead PRC stream and a bottoms stream, wherein the overhead PRC stream is enriched with PRC with respect to the bottoms stream.

2. The process of claim 1, wherein the light phase is extracted with at least one hydrophobic extractant.

3. The process of claim 2, wherein the at least one hydrophobic extractant comprises a C_6 to C_{16} alkane.

4. The process of claim 2, wherein the at least one hydrophobic extractant comprises a C_8 to C_{12} alkane.

5. The process of claim 2, wherein the at least one hydrophobic extractant comprises decane, dodecane, or combinations thereof.

6. The process of claim 2, wherein the at least one hydrophobic extractant comprises decane.

7. The process of claim 2, wherein the process further comprises:

separating the raffinate in a recovery column to produce a distillate comprising the halogen promoter; and

introducing at least a portion of the distillate to a carbonylation reactor for producing the crude acetic acid composition.

8. The process of claim 1, wherein the raffinate further comprises at least one alkyl iodide selected from the group consisting of ethyl iodide, propyl iodide, butyl iodide, pentyl iodide, hexyl iodide, and isomers and mixtures thereof.

9. The process of claim 1, wherein the aqueous stream comprises less than 10 wt.% of halogen promoter.

10. The process of claim 1, wherein the aqueous stream comprises less than 5 wt.% of halogen promoter.

11. The process of claim 1, wherein at least 70% of the halogen promoter in the light phase is extracted into the raffinate.

12. The process of claim 1, wherein at least 85% of the halogen promoter in the light phase is extracted into the raffinate.

13. The process of claim 1, wherein at least 95% of the halogen promoter in the light phase is extracted into the raffinate.

14. The process of claim 1, wherein the raffinate is substantially free of the at least one PRC.

15. The process of claim 1, wherein the bottoms stream comprises less than 500 wppm of halogen promoter.

16. The process of claim 1, wherein the bottoms stream comprises less than 200 wppm of halogen promoter.

17. The process of claim 1, wherein the bottoms stream comprises less than 100 wppm of halogen promoter.

18. The process of claim 1, wherein the bottoms stream may be purged from the system without a water extraction.

19. The process of claim 1, wherein the overhead PRC stream comprises less than 500 wppm of halogen promoter.

20. The process of claim 1, wherein the overhead PRC stream comprises less than 200 wppm of halogen promoter.

21. The process of claim 1, wherein the overhead PRC stream comprises less than 100 wppm of halogen promoter.

22. A process for removing permanganate reducing compounds (PRC's) from a crude acetic acid composition, the process comprising the steps of:

separating the crude acetic acid composition in a light ends column into an overhead vapor stream comprising halogen promoter, water, acetic acid, methyl acetate, methanol, dimethyl ether, and at least one PRC, and an acetic acid product stream;

condensing and biphasically separating the overhead vapor stream into a heavy phase and a light phase; and

extracting the light phase to obtain an aqueous stream comprising methyl acetate and at least one PRC, and a raffinate comprising halogen promoter, and methyl acetate.

23. The process of claim 22, wherein the light phase is extracted with at least one hydrophobic extractant.

24. The process of claim 23, wherein the at least one hydrophobic extractant comprises a C_6 to C_{16} alkane.

25. The process of claim 23, wherein the at least one hydrophobic extractant comprises a C_8 to C_{12} alkane.

26. The process of claim 23, wherein the at least one hydrophobic extractant comprises decane, dodecane, or combinations thereof.

27. The process of claim 23, wherein the at least one hydrophobic extractant comprises decane.

28. A process for removing permanganate reducing compounds (PRC's) from a crude acetic acid composition, the process comprising the steps of:

separating the crude acetic acid composition to form a condensed heavy phase and a condensed light phase comprising C_{2+} alkyl halide, halogen promoter and at least one PRC;

extracting the light phase to obtain an aqueous stream comprising methyl acetate and at least one PRC, and a raffinate comprising halogen promoter, C_{2+} alkyl halide and methyl acetate; wherein at least 70 wt.% of the halogen promoter and C_{2+} alkyl halide present in the light phase is extracted into the raffinate; and

separating the aqueous stream in a distillation column into an overhead PRC stream and a bottoms stream.

29. The process of claim 28, wherein the extracting utilizes a hydrophobic extractant comprising a C_6 to C_{16} alkane.

30. The process of claim 28, wherein the process further comprises:

separating the raffinate to produce a distillate comprising halogen promoter and a residue comprising extractant; and

recycling the distillate to a carbonylation reactor for producing the crude acetic acid composition.

31. The process of claim 28, wherein an overall C_{2+} alkyl halide and halogen promoter recovery from the crude product composition is at least 70 wt.%.

32. The process of claim 28, wherein the raffinate comprises less than 10 wt.% PRC and greater than a minor amount of halogen promoter and C_{2+} alkyl halide

33. The process of claim 28, wherein the aqueous stream comprises less than 10 wt.% halogen promoter and C_{2+} alkyl halide and greater than a minor amount of PRC.

34. A process for removing permanganate reducing compounds (PRC's) from a crude acetic acid composition, the process comprising the steps of:

providing a carbonylation reaction process stream comprising 0.01 to 4 wt.% of at least one PRC and 0.01 to 1 wt.% halogen promoter;

separating via extraction the carbonylation process stream to form an aqueous stream comprising at least one PRC and halogen promoter, and a raffinate; and

separating at least a portion of the aqueous stream to form an overhead PRC stream and a bottoms stream.

35. The process of claim 34, wherein the extraction utilizes a hydrophobic extractant comprising a C_6 to C_{16} alkane.

36. The process of claim 34, wherein the process further comprises:

separating the raffinate to produce a distillate comprising halogen promoter and a residue comprising extractant; and

recycling the distillate to a carbonylation reactor.

37. The process of claim 34, wherein the carbonylation reaction process stream comprises 0.50 to 2 wt.% of at least one PRC and 0.05 to 0.90 wt.% halogen promoter and wherein the

aqueous stream comprises 0.50 to 1.50 wt.% of at least one PRC and 0.03 to 0.10 wt.% halogen promoter.

38. The process of claim 34, wherein the carbonylation reaction process stream comprises 0.75 to 1.50 wt.% of at least one PRC and 0.10 to 0.50 wt.% halogen promoter and wherein the aqueous stream comprises 0.75 to 1.25 wt.% of at least one PRC and 0.04 to 0.08 wt.% halogen promoter.

We claim:

1. A process for removing permanganate reducing compounds (PRC's) from a crude acetic acid composition, the process comprising the steps of:

separating the crude acetic acid composition in a light ends column into an overhead vapor stream comprising halogen promoter, water, acetic acid, methyl acetate, methanol, dimethyl ether, and at least one PRC, and an acetic acid product stream;

condensing and biphasically separating the overhead vapor stream into a heavy phase and a light phase;

extracting the light phase to obtain an aqueous stream comprising methyl acetate and at least one PRC, and a raffinate comprising halogen promoter, and methyl acetate; and

separating the aqueous stream in a distillation column into an overhead PRC stream and a bottoms stream, wherein the overhead PRC stream is enriched with PRC with respect to the bottoms stream.

2. The process of claim 1, wherein the light phase is extracted with at least one hydrophobic extractant.

3. The process of claim 2, wherein the at least one hydrophobic extractant comprises a C_6 to C_{16} alkane.

4. The process of claim 2, wherein the at least one hydrophobic extractant comprises a C_8 to C_{12} alkane.

5. The process of claim 2, wherein the at least one hydrophobic extractant comprises decane, dodecane, or combinations thereof.

6. The process of claim 2, wherein the at least one hydrophobic extractant comprises decane.

7. The process of claim 2, wherein the process further comprises:

separating the raffinate in a recovery column to produce a distillate comprising the halogen promoter; and

introducing at least a portion of the distillate to a carbonylation reactor for producing the crude acetic acid composition.

8. The process of claim 1, wherein the raffinate further comprises at least one alkyl iodide selected from the group consisting of ethyl iodide, propyl iodide, butyl iodide, pentyl iodide, hexyl iodide, and isomers and mixtures thereof.

9. The process of claim 1, wherein the aqueous stream comprises less than 10 wt. % of halogen promoter.

10. The process of claim 1, wherein the aqueous stream comprises less than 5 wt. % of halogen promoter.

11. The process of claim 1, wherein at least 70% of the halogen promoter in the light phase is extracted into the raffinate.

12. The process of claim 1, wherein at least 85% of the halogen promoter in the light phase is extracted into the raffinate.

13. The process of claim 1, wherein at least 95% of the halogen promoter in the light phase is extracted into the raffinate.

14. The process of claim 1, wherein the raffinate is free of the at least one PRC.

15. The process of claim 1, wherein the bottoms stream comprises less than 500 wppm of halogen promoter.

16. The process of claim 1, wherein the bottoms stream comprises less than 200 wppm of halogen promoter.

17. The process of claim 1, wherein the bottoms stream comprises less than 100 wppm of halogen promoter.

18. The process of claim 1, wherein the bottoms stream may be purged from the system without a water extraction.

19. The process of claim 1, wherein the overhead PRC stream comprises less than 500 wppm of halogen promoter.

20. The process of claim 1, wherein the overhead PRC stream comprises less than 200 wppm of halogen promoter.

21. The process of claim 1, wherein the overhead PRC stream comprises less than 100 wppm of halogen promoter.

22. A process for removing permanganate reducing compounds (PRC's) from a crude acetic acid composition, the process comprising the steps of:

separating the crude acetic acid composition in a light ends column into an overhead vapor stream comprising halogen promoter, water, acetic acid, methyl acetate, methanol, dimethyl ether, and at least one PRC, and an acetic acid product stream;

condensing and biphasically separating the overhead vapor stream into a heavy phase and a light phase; and

extracting the light phase to obtain an aqueous stream comprising methyl acetate and at least one PRC, and a raffinate comprising halogen promoter, and methyl acetate.

23. The process of claim 22, wherein the light phase is extracted with at least one hydrophobic extractant.

24. The process of claim 23, wherein the at least one hydrophobic extractant comprises a C_6 to C_{16} alkane.

25. The process of claim 23, wherein the at least one hydrophobic extractant comprises a C_8 to C_{12} alkane.

26. The process of claim 23, wherein the at least one hydrophobic extractant comprises decane, dodecane, or combinations thereof.

27. The process of claim 23, wherein the at least one hydrophobic extractant comprises decane.