CLAIMS

WHAT IS CLAIMED IS:

1. A process for the preparation of hydroxy aldehyde comprising:

contacting in a reaction zone formaldehyde and another aldehyde in the presence of an amine catalyst under Aldol condensation conditions to produce a stream comprising a hydroxy aldehyde and amine salts;

contacting the stream with an alkaline additive to form a mixture; and

purifying the mixture to remove the amine salts to form a purified product comprising hydroxy aldehyde.

2. The process according to claim 1, wherein the purifying is carried out in a distillation column, wherein the alkaline additive is combined with at least some of the stream before being fed to the distillation column.

3. The process according to claim 1 wherein the purifying is carried out in a distillation column, wherein the alkaline additive is fed into the distillation column.

4. The process according to any of claims 1-3, wherein the contacting of formaldehyde and another aldehyde is carried out in a reactor, wherein the stream is removed from the reactor prior to contact with the alkaline additive.

5. A process comprising:

conducting an Aldol condensation reaction in a reaction zone containing an amine catalyst to thereby produce a reaction mixture comprising a hydroxy aldehyde, wherein one or more amine salts are produced during the Aldol condensation reaction;

purifying at least a portion the reaction mixture in a purification zone to thereby produce a purified product comprising at least a portion of the hydroxy aldehyde; and

contacting an alkaline additive with the amine salts to thereby cause dissociation of at least a portion of the amine salts

6. The process according to claim 5, wherein the alkaline additive is added in the purification zone.

7. The process according to claim 5, wherein the alkaline additive is added upstream of the purification zone

8. The process according to claim 5 or 7, wherein the alkaline additive is added downstream of the reaction zone.

9. The process according to any of claims 5-8, wherein the Aldol condensation reaction includes contacting formaldehyde and another aldehyde with the amine catalyst.

10. The process according to any of claims 1, 2, 3, 4 or 9, wherein the another aldehyde comprises formaldehyde, propionaldehyde, n-butyraldehyde, isobutyraldehyde, valeraldehyde, 2-methylbutyraldehyde, 3-methylbutyraldehyde (isovaleraldehyde), 2,2-dimethylpropionaldehyde (pivalinaldehyde), caproaldehyde, 2-methylvaleraldehyde, 3-methylvaleraldehyde, 4-methylvaleraldehyde, 2-ethylbutyraldehyde, 2,2-dimethylbutyraldehyde, 3,3-dimethylbutyraldehyde, caprylic aldehyde, capric aldehyde, or glutaraldehyde.

11. The process according to any of claims 1, 2, 3, 4 or 9, wherein the another aldehyde is isobutyraldehyde.

12. The process according to any of claims 1-11, wherein the reaction zone comprises a homogeneous phase comprising the amine catalyst.

13. The process according to any of claims 1-12, wherein the hydroxy aldehyde comprises 3-hydroxypropanal, dimethylolethanal, trimethylolethanal (pentaerythrital), 3-

hydroxybutanal (acetaldol), 3-hydroxy-2-ethylhexanal (butyl aldol), 3-hydroxy-2-methylpentanal (propyl aldol), 2-methylolpropanal, 2,2-dimethylolpropanal, 3-hydroxy-2-methylbutanal, 3-hydroxypentanal, 2-methylolbutanal, 2,2-dimethylolbutanal, or hydroxypivaldehyde.

14. The process according to any of claims 1-13, wherein the amine catalyst is triethylamine, tri-n-propylamine, tri-n-butylamine, trimethlyamine, or mixtures thereof.

15. The process according to any of claims 1-14, wherein the alkaline additive comprises a carbonate, a hydrogen carbonate, or a hydroxide of an alkali metal or alkaline earth metal.

16. The process according to any of claims 1-14, wherein the alkaline additive is Na_2CO_3, K_2CO_3, $CaCO_3$, $NaHCO_3$, $KHCO_3$, NaOH, KOH, $Ca(OH)_2$, or combinations thereof.

17. The process according any of claims 1-16, wherein the purifying comprises distillation.

18. The process according to claim 17, wherein the distillation produces an overhead stream, wherein at least a portion of said overhead stream is recycled to the reaction zone.

19. The process according to claim 18, wherein the overhead stream comprises at least a portion of the amine catalyst.

20. The process according to any of claims 1-19, wherein the alkaline additive contacted with the amine salts is in an amount that is less than 10 weight percent excess compared to the weight percent of the amine salts.

21. The process according to any of claims 1-20, wherein the conditions in the reaction zone comprise a temperature in the range of from about 20° C to about 150° C,

a pressure in the range from about 5 psig to about 100 psig, and a total reaction time in the range of from about 30 minutes to about 2 hours.

22. The process according to any of claims 1-21, wherein the purifying produces a purified stream comprising the purified product and the method further comprises measuring the sodium and/or nitrogen content of the purified stream and metering the amount of the alkaline additive contacted with the stream based on the measured sodium and/or nitrogen content of the purified stream.

23. The process according to any of claims 1-22, wherein the process further comprises hydrogenating the purified product to form a polyol.

24. The process according to any of claims 1-23, wherein the process is a continuous process.

25. The process according to any of claims 1-24, wherein the amine catalyst is trimethylamine, and the alkaline additive is NaOH.

CLAIMS

1. A process for the preparation of hydroxy aldehyde comprising:
contacting in a reaction zone formaldehyde and another aldehyde in the presence of an amine catalyst under Aldol condensation conditions to produce a stream comprising a hydroxy aldehyde and amine salts;

contacting the stream with an alkaline additive to form a mixture; and

purifying the mixture to remove the amine salts to form a purified product comprising hydroxy aldehyde.

2. The process according to claim 1, wherein the purifying is carried out in a distillation column, wherein the alkaline additive is combined with at least some of the stream before being fed to the distillation column.

3. The process according to claim 1, wherein the purifying is carried out in a distillation column, wherein the alkaline additive is fed into the distillation column.

4. The process according to any one of claims 1-3, wherein the contacting of formaldehyde and another aldehyde is carried out in a reactor, wherein the stream is removed from the reactor prior to contact with the alkaline additive.

5. A process comprising:

conducting an Aldol condensation reaction in a reaction zone containing an amine catalyst to thereby produce a reaction mixture comprising a hydroxy aldehyde, wherein one or more amine salts are produced during the Aldol condensation reaction;

purifying at least a portion the reaction mixture in a purification zone to thereby produce a purified product comprising at least a portion of the hydroxy aldehyde; and

contacting an alkaline additive with the amine salts to thereby cause dissociation of at least a portion of the amine salts, wherein the alkaline additive is added in the purification zone.

6. The process according to claim 5, wherein the alkaline additive is added upstream of the purification zone

7. The process according to claim 5 or claim 6, wherein the alkaline additive is added downstream of the reaction zone.

8. The process according to any of claims 5-7, wherein the Aldol condensation reaction includes contacting formaldehyde and another aldehyde with the amine catalyst.

9. The process according to any one of claims 1-4 or 9, wherein the another aldehyde comprises formaldehyde, propionaldehyde, n-butyraldehyde, isobutyraldehyde, valeraldehyde, 2-methylbutyraldehyde, 3-methylbutyraldehyde (isovaleraldehyde), 2,2-dimethylpropionaldehyde (pivalinaldehyde), caproaldehyde, 2-methylvaleraldehyde, 3-methylvaleraldehyde, 4-methylvaleraldehyde, 2-ethylbutyr-aldehyde, 2,2-dimethylbutyraldehyde, 3,3-dimethylbutyraldehyde, caprylic aldehyde, capric aldehyde, or glutaraldehyde.

10. The process according to any one of claims 1-4 or 9, wherein the another aldehyde is isobutyraldehyde.

11. The process according to any one of claims 1-10, wherein the reaction zone comprises a homogeneous phase comprising the amine catalyst.

12. The process according to any one of claims 1-11, wherein the hydroxy aldehyde comprises 3-hydroxypropanal, dimethylolethanal, trimethylolethanal (pentaerythrital), 3-hydroxybutanal (acetaldol), 3-hydroxy-2-ethylhexanal (butyl aldol), 3-hydroxy-2-methylpentanal (propyl aldol), 2-methylolpropanal, 2,2-dimethylolpropanal, 3-hydroxy-2-methylbutanal, 3-hydroxypentanal, 2-methylolbutanal, 2,2-dimethylol-butanal, or hydroxylpivaldehyde.

13. The process according to any one of claims 1-12, wherein the amine catalyst is tri-

ethylamine, tri-n-propylamine, tri-n-butylamine, trimethlyamine, or mixtures thereof.

14. The process according to any one of claims 1-13, wherein the alkaline additive comprises a carbonate, a hydrogen carbonate, or a hydroxide of an alkali metal or alkaline earth metal.

15. The process according to any one of claims 1-13, wherein the alkaline additive is Na_2CO_3, K_2CO_3, $CaCO_3$, $NaHCO_3$, $KHCO_3$, NaOH, KOH, $Ca(OH)_2$, or combinations thereof.

16. The process according any one of claims 1-15, wherein the purifying comprises distillation.

17. The process according to claim 16, wherein the distillation produces an overhead stream, wherein at least a portion of said overhead stream is recycled to the reaction zone.

18. The process according to claim 17, wherein the overhead stream comprises at least a portion of the amine catalyst.

19. The process according to any one of claims 1-18, wherein the alkaline additive contacted with the amine salts is in an amount that is less than 10 weight percent excess compared to the weight percent of the amine salts.

20. The process according to any one of claims 1-19, wherein the conditions in the reaction zone comprise a temperature in the range of from about 20° C to about 150° C, a pressure in the range from about 5 psig to about 100 psig, and a total reaction time in the range of from about 30 minutes to about 2 hours.

21. The process according to any one of claims 1-20, wherein the purifying produces a purified stream comprising the purified product and the method further comprises

measuring the sodium and/or nitrogen content of the purified stream and metering the amount of the alkaline additive contacted with the stream based on the measured sodium and/or nitrogen content of the purified stream.

22. The process according to any one of claims 1-21, wherein the process further comprises hydrogenating the purified product to form a polyol.

23. The process according to any one of claims 1-22, wherein the process is a continuous process.

24. The process according to any one of claims 1-23, wherein the amine catalyst is trimethylamine, and the alkaline additive is NaOH.