CLAIMS

WHAT IS CLAIMED IS:

1. A process for producing a polyol comprising:

contacting formaldehyde and another aldehyde in the presence of an amine catalyst and a promoter under Aldol condensation conditions to produce hydroxy aldehyde; and

hydrogenating the hydroxy aldehyde to form a polyol.

2. The process according to claim 1, further comprising purifying said hydroxy aldehyde prior to hydrogenation and recovering said amine catalyst.

3. The process according to claim 1, wherein the polyol is propylene glycol, ethylene glycol, dipropylene glycol, diethylene glycol, 1,4-butanediol, neopentyl glycol, triethanolamine, or glycerol.

4. The process according to claim 1, wherein the hydroxy aldehyde is 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.

5. The process according to claim 1, wherein said another aldehyde is 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.

6. The process according to claim 1, wherein the amine catalyst is triethylamine, tri-n-propylamine, tri-n-butylamine, trimethlyamine, or mixtures thereof.

7. The process according to claim 1, wherein the promoter is an alkali metal or alkaline earth metal of a carbonate, a hydrogen carbonate, a hydroxide, or mixtures thereof.

8. The process according to claim 7, wherein the promoter is Na_2CO_3, K_2CO_3, $CaCO_3$, $NaHCO_3$, $KHCO_3$, NaOH, KOH, $Ca(OH)_2$, or combinations thereof.

9. A process for producing neopentyl glycol comprising:

contacting formaldehyde and isobutyraldehyde in the presence of an amine catalyst and a promoter under Aldol condensation conditions to produce hydroxypivaldehyde; and

hydrogenating the hydroxypivaldehyde to form neopentyl glycol.

10. The process according to claim 9, further comprising purifying said hydroxypivaldehyde prior to hydrogenation and recovering said catalyst.

11. The process according to claim 9, wherein the amine catalyst is triethylamine, tri-n-propylamine, tri-n-butylamine, trimethlyamine, or mixtures thereof.

12. The process according to claim 9, wherein the promoter is an alkali metal or alkaline earth metal of a carbonate, a hydrogen carbonate, a hydroxide, or mixtures thereof.

13. The process according to claim 12, wherein the promoter is Na_2CO_3, K_2CO_3, $CaCO_3$, $NaHCO_3$, $KHCO_3$, NaOH, KOH, $Ca(OH)_2$, or combinations thereof.

14. A process for producing a hydroxy aldehyde comprising:

contacting formaldehyde and another aldehyde in the presence of an amine catalyst and a promoter under Aldol condensation conditions to produce hydroxy aldehyde.

15. The process according to claim 14, further comprising purifying said hydroxy aldehyde and recovering said catalyst.

16. The process according to claim 14, wherein the hydroxy aldehyde is 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.

17. The process according to claim 14, wherein said another aldehyde is 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.

18. The process according to claim 14, wherein the amine catalyst is triethylamine, tri-n-propylamine, tri-n-butylamine, trimethlyamine, or mixtures thereof.

19. The process according to claim 14, wherein the promoter is an alkali metal or alkaline earth metal of a carbonate, a hydrogen carbonate, a hydroxide, or mixtures thereof.

20. The process according to claim 19, wherein the promoter is Na_2CO_3, K_2CO_3, $CaCO_3$, $NaHCO_3$, $KHCO_3$, NaOH, KOH, $Ca(OH)_2$, or combinations thereof.

CLAIMS

WHAT IS CLAIMED IS:

1. A process comprising contacting formaldehyde and another aldehyde in the presence of an amine catalyst and a promoter comprising a base in a reaction zone under Aldol condensation conditions to produce hydroxy aldehyde.

2. The process according to claim 1 wherein the contacting of formaldehyde and another aldehyde causes the formation of one or more amine salts.

3. 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; and

contacting the amine salts with a base to thereby cause dissociation of at least a portion of the amine salts.

4. The process according to claim 3, wherein the Aldol condensation reaction includes contacting formaldehyde and another aldehyde with the amine catalyst.

5. The process according to any of claims 1-4, 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.

6. The process according to claim 1, 2 or 4, wherein said 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.

7. The process according to claim 1, 2, or 4, wherein the another aldehyde is isobutyraldehyde.

8. The process according to any of claims 1-7, wherein the base is fed to the reaction zone.

9. The process according to any of claims 1-7, wherein the base is added to a feed to the reaction zone upstream of the reaction zone.

10. The process according to any of claims 1-9, wherein the base is present in the reaction zone in an amount of about 500 ppm to about 3000 ppm by weight.

11. The process according to any of claims 1-10, wherein the base is present in an amount sufficient to achieve dissociation of the amine salts.

12. The process according to any of claims 1-11, wherein the base is present in an amount that is less than 10 weight percent excess compared to the weight percent of the amine salts.

13. The process according to any of claims 1-12, further comprising purifying at least a portion of the hydroxy aldehyde in a purification zone to thereby produce a purified product.

14. The process according to any of claims 1-13, further comprising hydrogenating the hydroxy aldehyde to form a polyol.

15. The process according to claim 14, wherein the polyol comprises propylene glycol, ethylene glycol, dipropylene glycol, diethylene glycol, 1,4-butanediol, neopentyl glycol, triethanolamine, or glycerol.

16. The process according to any of claims 14 or 15, further comprising purifying at least a portion of the hydroxy aldehyde to thereby produce a purified product and the hydrogenating occurs subsequent to the purifying.

17. The process according to claim 13 or 15, wherein the purifying is by distillation and produces an overhead stream and wherein at least a portion of said overhead stream is recycled back to the reaction zone, wherein the overhead stream comprises at least a portion of the amine catalyst.

18. The process according to any of claims 13, 16 or 17, further comprising measuring the sodium and nitrogen content of the purified product, further comprising controlling the amount of the base contacted with the amine salt based on the measured sodium and nitrogen content of the purified product.

19. The process according to any of claims 1-18, wherein the amine catalyst is triethylamine, tri-n-propylamine, tri-n-butylamine, trimethlyamine, or mixtures thereof.

20. The process according to any of claims 1-18, wherein the base comprises a carbonate, a hydrogen carbonate, or a hydroxide of an alkali metal or alkaline earth metal.

21. The process according to any of claims 1-18, wherein the base is selected from Na_2CO_3, K_2CO_3, $CaCO_3$, $NaHCO_3$, $KHCO_3$, NaOH, KOH, $Ca(OH)_2$, or combinations thereof.

22. The process according to any of claims 1-21, wherein the reaction zone comprises a homogeneous reaction mixture.

23. The process according to any of claims 1-22, wherein the amine catalyst is trimethylamine, and the base is NaOH.

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 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.