Claims

1. A process of preparing an ethylenically unsaturated amide or an ethylenically unsaturated carboxylic acid or salt thereof from the corresponding ethylenically unsaturated nitrile in which the nitrile is subjected to a hydration or hydrolysis reaction in an aqueous medium in the presence of a biocatalyst, wherein the nitrile contains above 2 ppm acrolein and the amide or carboxylic acid or salt thereof contains less than 2 ppm acrolein.

2. A process according to claim 1 in which the biocatalyst is a microorganism that is capable of producing a nitrile hydratase.

3 A process according to claim 1 in which the biocatalyst is a microorganism that is capable of producing a nitrile hydratase and an amidase.

4. A process according to claim 1 in which the biocatalyst is a microorganism that is capable of producing a nitrilase.

5. A process according to any of claims 1 to 4 in which the biocatalyst is a microorganism of the Rhodococcus genus.

6. A process according to any of claims 1 to 5 in which the biocatalyst is a microorganism of the Rhodococcus rhodochrous species.

7. A process according to any of claims 1 to 6 in which the biocatalyst is selected from the group consisting of a microorganism which is Rhodococcus rhodochrous strain 2368 (NCIMB 41164), a mutant thereof and a nitrile hydratase obtainable from Rhodococcus rhodochrous strain 2368 or a mutant thereof.

8. A process according to any of claims 1 to 6 in which the biocatalyst is selected from the group consisting of a microorganism which is Rhodococcus rhodochrous J1), a mutant thereof and a nitrile hydratase obtainable from Rhodococcus rhodochrous J1 or a mutant thereof.

9. A process according to any of claims 1 to 5 in which the biocatalyst is a microorganism of the Rhodococcus ruber species.

10. A process according to any of claims 1 to 5 or claim 9 in which the biocatalyst is selected from the group consisting of a microorganism which is

Rhodococcus ruber NCIMB 40833, a mutant thereof and a nitrilase obtainable from Rhodococcus ruber strain NCIMB 40833 or a mutant thereof.

11. A process according to any of claims 1 to 5 or claim 9 in which the biocatalyst is selected from the group consisting of a microorganism which is Rhodococcus ruber NCIMB 40757, a mutant thereof and a nitrilase obtainable from Rhodococcus ruber strain NCIMB 40757 or a mutant thereof.

12. A process according to any of claims 1 to 4 in which the biocatalyst is selected from the group consisting of a microorganism which is Dietzia natronolimaios NCIMB 41165, a mutant thereof and a nitrile hydratase and amidase obtainable from Dietzia natronolimaios NCIMB 41165, or a mutant thereof.

13. A process according to any of claims 1 to 12 in which the biocatalyst comprises whole cells.

14. A process according to any of claims 1 to 13 in which the biocatalyst comprises fractured cellular material.

15. A process according to any of claims 1 to 14 in which the amide is (meth)acrylamide.

16. A process according to any of claims 1 to 15 in which the carboxylic acid is (meth) acrylic acid (salts).

17. A process according to any of claims 1 to 16 in which the nitrile contains at least 10 ppm acrolein.

18. A process according to any of claims 1 to 17 in which the nitrile contains at least 20 ppm acrolein.

19. A process according to any of claims 1 to 18 in which the nitrile contains up to 500 ppm acrolein.

20. Use of a biocatalyst for the purpose of reducing acrolein in an ethylenically unsaturated monomer.

21. Use according to claim 20 in which the ethylenically unsaturated monomer is selected from the group consisting of (meth) acrylamide, (meth) acrylic acid (or salts) and (meth) acrylonitrile.

22. Use according to claim 20 or claim 21 in which the biocatalyst has any of the features defined in claims 2 to 19.

23. A process for preparing a polymer of an ethylenically unsaturated monomer or blend comprising the ethylenically unsaturated monomer, which monomer has been formed from an ethylenically unsaturated nitrile, comprising the steps,

(i) contacting the ethylenically unsaturated nitrile with a biocatalyst to form the ethylenically unsaturated monomer,

(ii) optionally mixing the ethylenically unsaturated monomer with other monomers to form a blend, and

(iii) subjecting the ethylenically unsaturated monomer or blend to polymerisation conditions thereby forming the polymer,

wherein the ethylenically unsaturated nitrile contains above 2 ppm acrolein and the ethylenically unsaturated monomer contains less than 2 ppm acrolein.

24. A process according to claim 23 in which the ethylenically unsaturated monomer is selected from the group consisting of (meth) acrylamide and (meth) acrylic acid (or salts).

25. A process according to claim 23 or claim 24 in which the biocatalyst has any of the features defined in claims 2 to 8.

26. A process according to any of claims 23 to 25 in which the nitrile contains at least 10 ppm acrolein.

27. A process according to any of Claims 23 to 26 in which the nitrile contains at least 20 ppm acrolein.

The claims defining the invention are as follows:

1. A process of preparing an ethylenically unsaturated amide or an ethylenically unsaturated carboxylic acid or salt thereof from the corresponding ethylenically unsaturated nitrile in which the nitrile is subjected to a hydration or hydrolysis reaction in an aqueous medium in the presence of a biocatalyst, which biocatalyst is a microorganism that is capable of producing nitrile hydratase, a nitrile hydratase and an amidase, or a nitrilase,

wherein the nitrile contains above 2 ppm acrolein and the amide or carboxylic acid or salt thereof contains less than 2 ppm acrolein.

2. The process according to claim 1, in which the biocatalyst is a microorganism of the Rhodococcus genus.

3. The process according to claim 1 or 2, in which the biocatalyst is a microorganism of the Rhodococcus rhodochrous species.

4. The process according to any one of claims 1 to 3, in which the biocatalyst is selected from the group consisting of a microorganism which is Rhodococcus rhodochrous strain 2368 (NCIMB 41164), a mutant thereof and the nitrile hydratase obtainable from Rhodococcus rhodochrous strain 2368 or a mutant thereof.

5. The process according to any one of claims 1 to 3, in which the biocatalyst is selected from the group consisting of a microorganism which is Rhodococcus rhodochrous J1, a mutant thereof and a nitrile hydratase obtainable from Rhodococcus rhodochrous J1 or a mutant thereof.

6. The process according to claim 1 or 2, in which the biocatalyst is a microorganism of the Rhodococcus ruber species.

7. The process according to any one of claims 1, 2 or 6, in which the biocatalyst is selected from the group consisting of a microorganism which is Rhodococcus ruber NCIMB 40833, a mutant thereof and a nitrilase obtainable from Rhodococcus ruber strain NCIMB 40833 or a mutant thereof.

8. The process according to any one of claims 1, 2 or 6, in which the biocatalyst is selected from the group consisting of a microorganism which is Rhodococcus ruber NCIMB 40757, a mutant thereof and a nitrilase obtainable from Rhodococcus ruber strain NCIMB 40757 or a mutant thereof.

9. The process according to claim 1, in which the biocatalyst is selected from the group consisting of a microorganism which is Dietzia natronolimaios NCIMB 41165, a mutant thereof and a nitrile hydratase and amidase obtainable from Dietzia natronolimaios NCIMB 41165, or a mutant thereof.

10. The process according to any one of claims 1 to 9, in which the biocatalyst comprises whole cells.

11. The process according to any one of claims 1 to 10, in which the biocatalyst comprises fractured cellular material.

12. The process according to any one of claims 1 to 11, in which the amide is (meth) acrylamide.

13. The process according to any one of claims 1 to 12, in which the carboxylic acid is (meth) acrylic acid (salts).

14. The process according to any one of claims 1 to 13, in which the nitrile contains at least 10 ppm acrolein.

15. The process according to any one of claims 1 to 14, in which the nitrile contains at least 20 ppm acrolein.

16. The process according to any one of claims 1 to 15, in which the nitrile contains up to 500 ppm acrolein.

17. Use of a biocatalyst which biocatalyst is a microorganism that is capable of producing nitrile hydratase, a nitrile hydratase and an amidase, or a nitrilase, for the purpose of reducing the level of acrolein in an ethylenically unsaturated monomer.

18. The use according to claim 17 in which the ethylenically unsaturated monomer is selected from the group consisting of (meth) acrylamide, (meth) acrylic acid (or salts) and (meth) acrylonitrile.

19. The use according to claim 17 or 18, in which the biocatalyst has any of the features defined in claims 2 to 11.

20. A process for preparing a polymer of an ethylenically unsaturated monomer or blend comprising the ethylenically unsaturated monomer, which monomer has been formed from an ethylenically unsaturated nitrile, comprising the steps,

(i) contacting the ethylenically unsaturated nitrile with a biocatalyst which biocatalyst is a microorganism that is capable of producing nitrile hydratase, a nitrile hydratase and an amidase, or a nitrilase, to form the ethylenically unsaturated monomer,

(ii) optionally mixing the ethylenically unsaturated monomer with other monomers to form a blend, and

(iii) subjecting the ethylenically unsaturated monomer or blend to polymerisation conditions thereby forming the polymer,

wherein the ethylenically unsaturated nitrile contains above 2 ppm acrolein and the ethylenically unsaturated monomer contains less than 2 ppm acrolein.

21. The process according to claim 20, in which the ethylenically unsaturated monomer is selected from the group consisting of (meth) acrylamide and (meth) acrylic acid (or salts).

22. The process according to claim 20 or 21, in which the biocatalyst has any of the features defined in claims 2 to 5.

23. The process according to any one of claims 20 to 22, in which the nitrile contains at least 10 ppm acrolein.

24. The process according to any one of claims 20 to 23, in which the nitrile contains at least 20 ppm acrolein.

25. The process according to any one of claims 20 to 24, in which the nitrile contains up to 500 ppm acrolein.

26. A process of preparing an ethylenically unsaturated amide or an ethylenically unsaturated carboxylic acid or salt thereof as defined in claim 1 and substantially as herein described with reference to Example 1.