CLAIMS

What is claimed is:

1) A process for converting hydroxypropionic acid, hydroxypropionic acid derivatives, or mixtures thereof to acrylic acid, acrylic acid derivatives, or mixtures thereof comprising the following steps:
   a) Providing an aqueous solution comprising hydroxypropionic acid, hydroxypropionic acid derivatives, or mixtures thereof, wherein said hydroxypropionic acid is in monomeric form in said aqueous solution;
   b) Combining said aqueous solution with an inert gas to form an aqueous solution/gas blend;
   c) Evaporating said aqueous solution/gas blend to produce a gaseous mixture; and
   d) Dehydrating said gaseous mixture by contacting said gaseous mixture with a dehydration catalyst under a pressure of at least about 80 psig, producing said acrylic acid, acrylic acid derivatives, or mixtures thereof.

2) The process of any preceding claim, wherein the pressure is from about 80 psig to about 550 psig.

3) The process of any preceding claim, wherein the temperature during the evaporating step is from about 165°C to about 450°C.

4) The process of any preceding claim, wherein the GHSV in the evaporating step is from about 720 h^{-1} to about 36,000 h^{-1}.

5) The process of any preceding claim, wherein the temperature during the dehydrating step is from about 150°C to about 500°C.

6) The process of any preceding claim, wherein the GHSV in the dehydrating step is from about 720 h^{-1} to about 36,000 h^{-1}.

7) The process of any preceding claim, wherein the hydroxypropionic acid, hydroxypropionic acid derivatives, or mixtures thereof comprise from about 5 wt% to about 50 wt% of said aqueous solution.

8) The process of any preceding claim, wherein the gaseous mixture comprises from about 1 mol% to about 10 mol% of said hydroxypropionic acid, hydroxypropionic acid derivatives, or mixtures thereof.

9) The process of any preceding claim, wherein said evaporating step is performed in a reactor, wherein said reactor has an interior surface comprising material selected from the group consisting of quartz, borosilicate glass, silicon, hastelloy, inconel, manufactured sapphire, stainless steel, and mixtures thereof.

10) The process of any preceding claim, wherein said dehydrating step is performed in a reactor, wherein said reactor has an interior surface comprising material selected from the group consisting of quartz, borosilicate glass, silicon, hastelloy, inconel, manufactured sapphire, stainless steel, and mixtures thereof.

11) The process of claim 1, wherein said hydroxypropionic acid is lactic acid.

12) The process of claim 11, wherein the acrylic acid selectivity from the lactic acid is at least 50%.

13) The process of claim 11, wherein the propanoic acid selectivity from the lactic acid is less than about 5%.

14) The process of claim 11, wherein the conversion of said lactic acid is more than about 50%.

15) The process of any preceding claim, wherein said evaporating step is performed under a pressure from about 80 psig to about 550 psig.

AMENDED CLAIMS
received by the International Bureau on 05 November 2013 (05.11.13)

What is claimed is:

1) A process for converting bio-based lactic acid, bio-based lactic acid derivatives, or mixtures thereof to bio-based acrylic acid, bio-based acrylic acid derivatives, or mixtures thereof comprising the following steps:
   a) Providing an aqueous solution comprising bio-based lactic acid, bio-based lactic acid derivatives, or mixtures thereof, wherein said bio-based lactic acid is in monomeric form in said aqueous solution;
   b) Combining said aqueous solution with an inert gas to form an aqueous solution/gas blend;
   c) Evaporating said aqueous solution/gas blend to produce a gaseous mixture; and
   d) Dehydrating said gaseous mixture by contacting said gaseous mixture with a dehydration catalyst under a pressure of at least about 80 psig, producing said acrylic acid, acrylic acid derivatives, or mixtures thereof.

2) The process of any preceding claim, wherein the pressure is from about 80 psig to about 550 psig.

3) The process of any preceding claim, wherein the temperature during the evaporating step is from about 165°C to about 450°C.

4) The process of any preceding claim, wherein the GHSV in the evaporating step is from about 720 h^{-1} to about 36,000 h^{-1}.

5) The process of any preceding claim, wherein the temperature during the dehydrating step is from about 150°C to about 500°C.

6) The process of any preceding claim, wherein the GHSV in the dehydrating step is from about 720 h^{-1} to about 36,000 h^{-1}.

7) The process of any preceding claim, wherein the hydroxypropionic acid, hydroxypropionic acid derivatives, or mixtures thereof comprise from about 5 wt% to about 50 wt% of said aqueous solution.

8) The process of any preceding claim, wherein the gaseous mixture comprises from about 1 mol% to about 10 mol% of said hydroxypropionic acid, hydroxypropionic acid derivatives, or mixtures thereof.

9) The process of any preceding claim, wherein said evaporating step is performed in a reactor, wherein said reactor has an interior surface comprising material selected from the group consisting of quartz, borosilicate glass, silicon, hastelloy, inconel, manufactured sapphire, stainless steel, and mixtures thereof.

10) The process of any preceding claim, wherein said dehydrating step is performed in a reactor, wherein said reactor has an interior surface comprising material selected from the group consisting of quartz, borosilicate glass, silicon, hastelloy, inconel, manufactured sapphire, stainless steel, and mixtures thereof.

11) The process of claim 1, wherein said hydroxypropionic acid is lactic acid.

12) The process of claim 11, wherein the acrylic acid selectivity from the lactic acid is at least 50%.

13) The process of claim 11, wherein the propanoic acid selectivity from the lactic acid is less than about 5%.

14) The process of claim 11, wherein the conversion of said lactic acid is more than about 50%.

15) The process of any preceding claim, wherein said evaporating step is performed under a pressure from about 80 psig to about 550 psig.

CLAIMS

1. A process for converting bio-based lactic acid, bio-based lactic acid derivatives, or mixtures thereof to bio-based acrylic acid, bio-based acrylic acid derivatives, or mixtures thereof comprising the following steps:

a) providing an aqueous solution comprising bio-based lactic acid, bio-based lactic acid derivatives, or mixtures thereof, wherein said bio-based lactic acid is in monomeric form in said aqueous solution;

b) combining said aqueous solution with an inert gas to form an aqueous solution/gas blend;

c) evaporating said aqueous solution/gas blend to produce a gaseous mixture; and

d) dehydrating said gaseous mixture by contacting said gaseous mixture with a dehydration catalyst under a pressure of at least about 80 psig, producing said acrylic acid, acrylic acid derivatives, or mixtures thereof.

2. The process of claim 1, wherein the pressure is from about 80 psig to about 550 psig.

3. The process of claim 1 or 2, wherein the temperature during the evaporating step is from about 165°C to about 450°C.

4. The process of any one of the preceding claims, wherein the GHSV in the evaporating step is from about 720 h^{-1} to about 36,000 h^{-1}.

5. The process of any one of the preceding claims, wherein the temperature during the dehydrating step is from about 150°C to about 500°C.

6. The process of any one of the preceding claims, wherein the GHSV in the dehydrating step is from about 720 h^{-1} to about 36,000 h^{-1}.

7. The process of any one of the preceding claims, wherein the bio-based lactic acid, bio-based lactic acid derivatives, or mixtures thereof comprise from about 5 wt% to about 50 wt% of said aqueous solution.

8. The process of any one of the preceding claims, wherein the gaseous mixture comprises from about 1 mol% to about 10 mol% of said bio-based lactic acid, bio-based lactic acid derivatives, or mixtures thereof.

9. The process of any one of the preceding claims, wherein said evaporating step is performed in a reactor, wherein said reactor has an interior surface comprising material selected from the group consisting of quartz, borosilicate glass, silicon, hastelloy, inconel, manufactured sapphire, stainless steel, and mixtures thereof.

10. The process of any one of the preceding claims, wherein said dehydrating step is performed in a reactor, wherein said reactor has an interior surface comprising material selected from the group consisting of quartz, borosilicate glass, silicon, hastelloy, inconel, manufactured sapphire, stainless steel, and mixtures thereof.

11. The process of any one of the previous claims, wherein the acrylic acid selectivity from the bio-based lactic acid, bio-based lactic acid derivatives, or mixtures thereof, is at least 50%.

12. The process of any one of the previous claims, wherein the propanoic acid selectivity from the bio-based lactic acid, bio-based lactic acid derivatives, or mixtures thereof, is less than about 5%.

13. The process of any one of the previous claims, wherein the conversion of said bio-based lactic acid, bio-based lactic acid derivatives, or mixtures thereof, is more than about 50%.

14. The process of any one of the preceding claims, wherein said evaporating step is performed under a pressure from about 80 psig to about 550 psig.