CLAIMS

1. A method for controlling an acetic acid production process comprising:

A) combining, in a carbonylation reactor, a carbonylation catalyst, methanol, carbon monoxide, and water, to form a reactor mixture;

B) introducing one or more feed streams into the carbonylation reactor, wherein at least one feed stream comprising water, and at least one feed stream comprising methanol and methyl acetate, wherein the feed stream comprising methanol and methyl acetate has a methyl acetate:methanol weight ratio from 90:10 to 10:90;

C) measuring the concentration of one or more components in at least one feed stream and/or in the reactor mixture by Raman spectroscopic analysis or by infrared spectroscopic analysis; and

D) adjusting at least one feed stream comprising water in response to the concentration measured by Raman spectroscopic analysis or infrared spectroscopic analysis.

2. The method of claim 1, wherein the concentration of methanol in a feed stream and/or methyl acetate in a feed stream.

3. The method of claim 1, wherein the concentration is of methyl acetate in the reactor mixture, and wherein the conversion rate for methyl acetate from acetic acid is calculated from the concentration of methyl acetate in the reactor mixture and the methyl acetate feed rate.

4. The method of claim 1, wherein the reactor mixture comprises carbon dioxide, methane, and/or hydrogen.

5. The method of claim 1, wherein the concentration is of carbon dioxide, methane, and/or hydrogen in the reactor mixture.

6. The method of claim 1, wherein the adjusting of the feed stream comprising water achieves or maintains water in the reactor mixture in a concentration of 2-14 wt%.

7. The method of claim 1, wherein the adjusting is of a feed rate of a feed stream comprising water, and/or wherein the adjusting is to a water make-up feed stream by increasing or decreasing the concentration of water in the water make-up feed stream.

8. The method of claim 1, wherein the reactor mixture further comprises hydrogen iodide, and optionally comprises carbon dioxide, methyl iodide, and acetic acid.

9. The method of claim 8, wherein the reactor mixture further comprises a phosphine oxide.

10. The method of claim 8, wherein the reactor mixture further comprises methyl iodide and acetic acid.

11. The method of claim 1, wherein the reactor mixture further comprises a catalyst stabilizer and/or a catalyst promoter, optionally wherein the catalyst stabilizer is a pentavalent Group VA oxide and/or the catalyst promoter is methyl iodide.

12. The method of claim 11, wherein the pentavalent Group VA oxide is a phosphine oxide.

13. The method of claim 11, wherein when the catalyst promoter is methyl iodide, the reactor mixture further comprises methyl acetate, carbon dioxide, and acetic acid.

14. A method for controlling an acetic acid production process comprising:

a) combining, in a carbonylation reactor, a carbonylation catalyst, methanol, carbon monoxide, and water, to form a reactor mixture;

b) introducing a feed stream comprising methyl acetate and methanol into the carbonylation reactor, wherein the feed stream has a methyl acetate:methanol weight ratio from 85:15 to 15:85;

c) measuring the concentration of methyl acetate and/or methanol in the feed stream by Raman spectroscopic analysis or by infrared spectroscopic analysis; and

d) adjusting at least one feed stream comprising water in response to the concentration measured by Raman spectroscopic analysis or infrared spectroscopic analysis.

15. The method of claim 14, wherein the concentration of methyl acetate in the feed stream is measured.

16. The method of claim 14, wherein the feed stream has a methyl acetate:methanol weight ratio from 60:40 to 40:60.

17. The method of claim 14, wherein the adjusting is of a feed rate of the feed stream comprising water, and/or wherein the adjusting is to a water make-up feed stream, and wherein the adjusting is by increasing or decreasing the concentration of water in the water make-up feed stream.

18. The method of claim 14, wherein the adjusting of the feed stream comprising water achieves or maintains water in the reactor mixture in a concentration of 2-14 wt%.