CLAIMS

What is claimed is:

1. A method for the production of acetic acid comprising:

(A) reacting,

(i) methanol,

(ii) carbon monoxide, and

(iii) water,

in a carbonylation reactor in the presence of a carbonylation catalyst to produce a reactor mixture;

(B) measuring a first value for a reference component selected from the group consisting of glacial acetic acid (GAA), a pentavalent phosphine oxide, triphenyl phosphine oxide (TPPO), a catalyst promoter, a catalyst stabilizer, water, acetic acid, hydrogen iodide, methyl iodide, methyl acetate, acetaldehyde and carbon monoxide by Raman spectroscopic analysis with an uncoated probe or flow-through cell in contact with the reactor mixture;

(C) measuring a second value for the reference component and measuring the concentration of one or more components of interest selected from the group consisting of glacial acetic acid (GAA), a pentavalent phosphine oxide, a catalyst promoter, a catalyst stabilizer, water, acetic acid, hydrogen iodide, methyl iodide, methyl acetate, acetaldehyde and carbon monoxide in the reactor mixture by Raman spectroscopic analysis;

(D) determining an Adjustment Ratio by dividing the first value for the reference component by the second value for the reference component;

(E) calculating an Adjusted Value for the concentration of the component(s) of interest by multiplying the concentration of the component(s) of interest by the Adjustment Ratio; and

(F) modifying at least one process condition in the carbonylation reactor or a separation unit selected from the group consisting of temperature, pressure, component of interest concentration, feed stream flow rate and exit stream flow rate;

wherein the Adjustment Ratio is maintained at a value of 0.01-5.

2. The method of claim 1, wherein the catalyst stabilizer is a pentavalent Group VA oxide.

3. The method of claim 1, wherein the catalyst promoter is methyl iodide.

4. The method of claim 3, wherein the reactor mixture comprises:

(A) a carbonylation catalyst;

(B) methanol;

(C) methyl acetate;

(D) water;

(E) carbon monoxide;

(F) carbon dioxide;

(G) acetic acid; and

(H) methyl iodide.

5. The method of claim 1, wherein the reactor mixture comprises:

(A) a carbonylation catalyst;

(B) methanol;

(C) methyl acetate;

(D) water;

(E) carbon monoxide;

(F) carbon dioxide;

(G) methyl iodide;

(H) acetic acid; and

(I) hydrogen iodide.

6. The method of claim 5, wherein the reaction mixture further comprises a phosphine oxide.

7. The method of claim 1, wherein the Adjustment Ratio is less than 5.

8. The method of claim 1, wherein the at least one process condition is selected from the group consisting of:

   (A) the temperature of the carbonylation reactor;

   (B) the pressure of the carbonylation reactor;

   (C) the temperature of the separation unit;

   (D) the pressure of the separation unit;

   (E) the feed stream flow rate of a component of interest;

   (F) the flow rate of an exit stream;

   (G) the concentration of a component of interest; and

   (H) the selection of a component of interest.

9. The method of claim 1, wherein the reference component is measured as a function of Raman Total Signal Strength as measured by the Raman signal intensity on the y-axis of a Raman spectrum.

10. The method of claim 1, wherein the temperature range of the carbonylation reactor is about 150 °C to about 250 °C.

11. The method of claim 1, wherein the pressure range of the carbonylation reactor is about 1380 kPa to about 13,800 kPa.

12. The method of claim 1, wherein the carbonylation catalyst comprises rhodium or iridium.

13. The method of claim 1, wherein the uncoated probe produces a signal of at least 20%.