Most preferably, the concentration of methyl acetate is from about 2 wt% to about 8 wt%. Alternatively, methyl acetate or a mixture of methyl acetate and methanol from byproduct streams of the hydroysis/methanolysis of polyvinyl acetate can be used for the carbonylation reaction.

[0028] Preferably, the reaction is performed in the presence of methyl iodide. Methyl iodide is a catalyst promoter. Preferably, the concentration of methyl iodide is from about 0.6 wt% to about 36 wt% based on the total weight of the reaction medium. More preferably, the concentration of methyl iodide is from about 4 wt% to about 24 wt%. Most preferably, the concentration of methyl iodide is from about 6 wt% to about 20 wt%. Alternatively, methyl iodide can be generated in the carbonylation reactor by adding hydrogen iodide (HI).

[0029] Hydrogen may also be fed into the reactor. Addition of hydrogen can enhance the carbonylation efficiency. Preferably, the concentration of hydrogen is from about 0.1 mol% to about 5 mol% of carbon monoxide in the reactor. More preferably, the concentration of hydrogen is from about 0.3 mol% to about 3 mol% of carbon monoxide in the reactor.

[0030] Methanol and carbon monoxide are fed to the carbonylation reactor. The methanol feed to the carbonylation reaction can come from a syngas- methanol facility or any other source. Methanol does not react directly with carbon monoxide to form acetic acid. It is converted to methyl iodide by the hydrogen iodide present in the acetic reactor and then reacts with carbon monoxide and water to give acetic acid and regenerate the hydrogen iodide. Carbon monoxide not only becomes part of the acetic acid molecule, but it also plays an important role in the formation and stability of the active catalyst.

[0031] The carbonylation reaction is preferably performed at a temperature within the range of about 150oC to about 250oC. More preferably, the reaction is performed at a temperature within the range of about 150oC to about 200oC. The carbonylation reaction is preferably performed under a pressure within the range of about 200 psig (1,480.28 kPa) to about 2,000 psig (13,890.84 kPa). More preferably, the reaction is performed under a pressure within the range of about 300 psig (2,169.75 kPa) to about 500 psig (3,548.70 kPa).

[0032] After the carbonylation reaction, the reaction mixture is passed downstream to a number of separation units. Separations unit may be defined herein as a vessel or step in an acetic acid process which separates a feed stream into two or more separate

What is claimed is:

1. A method for determining the characteristic of one or more components in a step of an acetic acid production process, comprising:

providing a feed stream comprising multiple components to a separations unit, one of said components being acetic acid,

said separations unit separating said feed stream into two or more exit streams having a different composition from one another, and

measuring a characteristic of one or more said components in said separations unit by Raman spectroscopic analysis,

wherein said acetic acid production process comprises reacting methanol and carbon monoxide in the presence of a carbonylation catalyst.

2. The method of claim **1**, wherein the characteristic measured is concentration or density.

3. The method of claim **1**, wherein the separations unit is a distillation column or a decanter.

4. The method of claim **3**, wherein the characteristic of one or more components in a light phase of the decanter is measured.

5. The method of claim **3**, wherein the characteristic of one or more components in the distillation column bottoms is measured.

6. The method of claim **1**, wherein the one or more components is selected from the group consisting of methyl iodide, methyl acetate, water, acetic acid, hydrogen iodide, acetaldehyde, and mixtures thereof.

7. The method of claim **1**, wherein the feed stream comprises MeI.

8. The method of claim **1**, wherein the component is MeI.

9. The method of claim **1**, wherein the feed stream comprises H_2O.

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

(i) reacting methanol and carbon monoxide in the presence of a carbonylation catalyst to produce a reactor product comprising acetic acid;