CLAIMS

1. A process for separating a feed stream comprising acetic acid and water in a distillation column, the column comprising

a bottom section in thermal communication with a heat source, the heat source having internal surfaces;

a feed inlet positioned above the bottom section;

a first outlet positioned above the feed inlet; and

a second outlet positioned below the feed inlet;

the process comprising

introducing the feed stream into the column through the feed inlet;

at a first heating rate of the heat source, separating the feed stream to form a water-rich first fraction and an acetic acid-rich second fraction;

measuring an internal temperature of the column at a first position between the first outlet and the second outlet;

measuring an internal pressure of the column at a second position between the first outlet and the second outlet;

determining a corrected temperature of the column based on the measured internal pressure and internal temperature of the column; and

determining that the corrected temperature is greater than a target value, and then adjusting the heat source to a second heating rate lower than the first heating rate; or

determining that the corrected temperature is lower than a target value, and then adjusting the heat source to a second heating rate greater than the first heating rate;

withdrawing at least a portion of the first fraction through the first outlet; and

withdrawing at least a portion of the second fraction through the second outlet, wherein water is present in the withdrawn second fraction in an amount within the range of 500 ppm to 1500 ppm by weight (ppmw), and

wherein at least one of the bottom section, the second outlet, the internal surfaces of the heat source, any connecting pipework between the second outlet and the heat source, and any internals in the bottom section of the column comprise zirconium.

2. The process of claim 1, wherein water is present in the withdrawn second fraction in an amount within the range of 800 ppmw to 1,200 ppmw.

3. The process of claim 1 or 2, wherein acetic acid is present in the withdrawn second fraction in an amount of at least 95 wt.% (e.g., at least 97.5 wt.%, or at least 99 wt.%).

4. The process of any of claims 1–3, wherein the feed stream comprises 1–10 wt.% (e.g., 2–7.5 wt.%, or 2–5 wt.%) water, 90–99 wt.% (e.g., 92.5–98 wt.%, or 95–98 wt.%) acetic acid, up to 1 wt.% (e.g., up to 0.75 wt.%) methyl iodide, and up to 5 wt.% (e.g. up to 3.5 wt.%) methyl acetate.

5. The process of any of claims 1–3, wherein the feed stream comprises 1–10 wt.% (e.g., 2–7.5 wt.%, or 2–5 wt.%) water, 40–85 wt.% (e.g., 40–75 wt.%, or 55–85 wt.%) acetic acid, 10–25 wt.% (e.g., 15–20 wt.%) methyl iodide, and 15–30 wt.% (e.g., 20–25 wt.%) methyl acetate.

6. The process of any of claims 1–5, wherein the internal temperature and the internal pressure of the column are each individually measured at a position between the feed inlet and the second outlet.

7. The process of any of claims 1–5, wherein the internal temperature and the internal pressure of the column are each individually measured at a position separated from the second outlet by no more than 50% (e.g., no more than 45%, or no more than 40%) of a total number of theoretical stages separating the first outlet and the second outlet.

8. The process of any of claims 1–7, wherein the measured internal pressure is within the range of 0.125 MPaG to 0.5 MPaG.

9. The process of any of claims 1–8, wherein the measured internal temperature is within the range of 110 °C to 200 °C (e.g., within the range of 120 °C to 190 °C, or 130 °C to 180 °C).

10. The process of any of claims 1–9, wherein determining the corrected temperature comprises adding a correction factor to the measured internal temperature of the column, the correction factor based on the measured internal pressure of the column.

11. The process of any of claims 1–10, wherein the heat source comprises a reboiler.

12. The process of any of claims 1–11, wherein at least the bottom section and the second outlet comprise zirconium.

13. The process of any of claims 1–12, wherein the second outlet comprises zirconium.

14. The process of any of claims 1–13, further comprising separating the withdrawn second fraction to produce a product stream comprising acetic acid and water, and a waste stream comprising heavy components, such as propionic acid.

15. A system for separating a feed stream comprising acetic acid and water, the system comprising

a distillation column capable of separating the feed stream to produce a water-rich first stream and an acetic acid-rich second stream, the second stream comprising water in an amount within the range of 500 ppmw to 1,500 ppmw, the column comprising

a bottom section in thermal communication with a heat source;

a feed inlet positioned above the bottom section;

a first outlet positioned above the feed inlet;

a second outlet positioned below the feed inlet;

a temperature sensor positioned between the first outlet and the second outlet; and

a pressure sensor positioned between the first outlet and the second outlet;

the heat source comprising a reboiler and a control unit capable of adjusting a heating rate of the reboiler based on an internal temperature measurement of the temperature sensor and an internal pressure measurement of the pressure sensor, and the heat source further having internal surfaces, and

wherein at least one of the bottom section, the second outlet, the internal surfaces of the heat source, any connecting pipework between the second outlet and the heat source, and any internals in the bottom section of the column comprise zirconium.

16. The system of claim 15, wherein the temperature sensor and the pressure sensor are each individually positioned between the feed inlet and the second outlet.

17. The system of claim 15, wherein the temperature sensor and the pressure sensor are each individually separated from the second outlet by no more than 50% (e.g., no more than 45%, or no more than 40%) of a total number of theoretical stages separating the first outlet and the second outlet.

18. The system of any of claims 15–17, further comprising a head pressure sensor capable of measuring a head pressure of the column.

19. The process of any of claims 15–18, wherein at least the bottom section and the second outlet comprise zirconium.

20. The system of any of claims 15–19, wherein the second outlet comprises zirconium.