CLAIMS

1. A method for producing acetic acid, comprising:

a carbonylation reaction step comprising reacting methanol with carbon monoxide in a reaction vessel in the presence of a catalyst system containing a metal catalyst and methyl iodide as well as acetic acid, methyl acetate, and water to produce acetic acid;

an evaporation step comprising separating a reaction mixture obtained in the carbonylation reaction step into a vapor stream and a residual liquid stream in an evaporator;

a lower boiling point component removal step comprising separating the vapor stream by distillation into an overhead stream rich in at least one lower boiling point component selected from methyl iodide and acetaldehyde and a first acetic acid stream rich in acetic acid;

a dehydration step comprising separating the first acetic acid stream by distillation into an overhead stream rich in water and a second acetic acid stream more enriched with acetic acid than the first acetic acid stream; and

an adsorptive removal step comprising treating the second acetic acid stream, or an acetic acid stream that has been more enriched with acetic acid by further purification of the second acetic acid stream, with an ion exchange resin,

wherein a nickel base alloy or zirconium is used as a material of a distillation column in the dehydration step, in the distillation column, a plate spacing between a charging mixture feeding plate and a column top vapor withdrawal plate is not less than one plate in terms of actual plates, and as metal ion concentrations in a charging mixture of the distillation column in the dehydration step, an iron ion concentration is less than 9,000 ppb by mass, a chromium ion concentration is less than 4,000 ppb by mass, a nickel ion concentration is less than 2,500 ppb by mass, a molybdenum ion concentration is less than 1,700 ppb by mass, and a zinc ion concentration is less than 800 ppb by mass, and

wherein the method includes, for controlling the metal ion concentrations in the charging mixture to be within the ranges, (i) employing a nickel base alloy or zirconium as the material of the charging pipe to the distillation column in the dehydration step; optionally (ii) providing an ion exchange resin column at a position between an outlet of the reaction vessel and an inlet of the distillation column in the dehydration step or an ion exchange resin vessel at a position between an outlet of the reaction vessel and an inlet of the distillation column in the dehydration step; and

(iii) using methanol having a zinc ion content of less than 10 ppm by mass as the methanol to be fed to the reaction vessel.

2. The method for producing acetic acid according to claim 1, wherein the catalyst system further contains an ionic iodide.

3. The method for producing acetic acid according to claim 1, wherein a zinc ion concentration in the charging mixture of the distillation column in the dehydration step is less than 500 ppb by mass.

4. The method for producing acetic acid according to claim 1, wherein operating conditions of the distillation column in the dehydration step are a column top temperature of less than 165°C and a column bottom temperature of less than 175°C.

5. The method for producing acetic acid according to claim 1, wherein an iron ion concentration in the second acetic acid stream obtained in the dehydration step is less than 21,000 ppb by mass.

6. The method for producing acetic acid according to claim 1, wherein as metal ion concentrations in the second acetic acid stream obtained in the dehydration step, an iron ion concentration is less than 21,000 ppb by mass, a chromium ion concentration is less than 7,100 ppb by mass, a nickel ion concentration is less than 4,000 ppb by mass, a molybdenum ion concentration is less than 3,000 ppb by mass, and a zinc ion concentration is less than 1,000 ppb by mass.

7. The method for producing acetic acid according to claim 1, wherein the material of a charging pipe to the distillation column in the dehydration step is a nickel base alloy or zirconium.

8. A method for producing acetic acid, comprising, in a distillation column having a nickel base alloy or zirconium as a material and having a plate spacing between a charging mixture

feeding plate and a column top vapor withdrawal plate of not less than one plate in terms of actual plates, feeding crude acetic acid having an iron ion concentration of less than 9,000 ppb by mass, a chromium ion concentration of less than 4,000 ppb by mass, a nickel ion concentration of less than 2,500 ppb by mass, a molybdenum ion concentration of less than 1,700 ppb by mass, a zinc ion concentration of less than 800 ppb by mass, a hexyl iodide concentration of less than 510 ppb by mass, and an acetic acid concentration of not less than 80% by mass into the charging mixture feeding plate via a charging pipe having a nickel base alloy or zirconium as a material, and conducting distillation at a column top temperature of less than 165°C and a column bottom temperature of less than 175°C to obtain an overhead stream rich in water and purified acetic acid having an iron ion concentration of less than 21,000 ppb by mass, a chromium ion concentration of less than 7,100 ppb by mass, a nickel ion concentration of less than 4,000 ppb by mass, a molybdenum ion concentration of less than 3,000 ppb by mass, and a zinc ion concentration of less than 1,000 ppb by mass, and

wherein the method includes, for controlling the metal ion concentrations in the charging mixture to be within the ranges, (i) employing a nickel base alloy or zirconium as the material of the charging pipe to the distillation column; optionally (ii) providing an ion exchange resin column at a position between an outlet of a reaction vessel and an inlet of the distillation column or an ion exchange resin vessel at a position between an outlet of a reaction vessel and an inlet of the distillation column; and (iii) using methanol having a zinc ion content of less than 10 ppm by mass as the methanol to be fed to a reaction vessel.

9. The method for producing acetic acid according to claim 1, wherein the iron ion concentration in the charging mixture of the distillation column in the dehydration step is less than 400 ppb by mass.

10. The method for producing acetic acid according to claim 8, wherein the crude acetic acid has an iron ion concentration of less than 3,000 ppb by mass.

11. The method for producing acetic acid according to claim 1, wherein operating condition of the distillation column in the dehydration step is a column bottom temperature of less than 173°C.

12. The method for producing acetic acid according to claim 8, wherein operating condition of the distillation column is a column bottom temperature of less than 173°C.

13. The method for producing acetic acid according to claim 1, wherein the chromium ion concentration in the charging mixture of the distillation column in the dehydration step is less than 200 ppb by mass.

14. The method for producing acetic acid according to claim 8, wherein the crude acetic acid has a chromium ion concentration of less than 1,500 ppb by mass.

15. The method for producing acetic acid according to claim 1, wherein the nickel ion concentration in the charging mixture of the distillation column in the dehydration step is less than 150 ppb by mass.

16. The method for producing acetic acid according to claim 8, wherein the crude acetic acid has a nickel ion concentration of less than 1,000 ppb by mass.

17. The method for producing acetic acid according to claim 1, wherein the molybdenum ion concentration in the charging mixture of the distillation column in the dehydration step is less than 170 ppb by mass.

18. The method for producing acetic acid according to claim 8, wherein the crude acetic acid has a molybdenum ion concentration of less than 700 ppb by mass.

19. The method for producing acetic acid according to claim 8, wherein the crude acetic acid has a zinc ion concentration of less than 650 ppb by mass.

20. The method for producing acetic acid according to claim 1, wherein as metal ion concentrations in the second acetic acid stream obtained in the dehydration step, an iron ion concentration is less than 200 ppb by mass, a chromium ion concentration is less than 100 ppb by mass, a nickel ion concentration is less than 70 ppb by mass, a molybdenum ion concentration is less than 50 ppb by mass, and a zinc ion concentration is less than 150 ppb by mass.