

CLAIMS

1. A method for purifying a crude liquid vinyl acetate feed comprising:
 - a) feeding a crude liquid vinyl acetate stream from a vinyl acetate monomer reactor into a first distillation tower, wherein the crude liquid vinyl acetate stream comprises vinyl acetate monomer, acetic acid, water, and ethyl acetate;
 - b) distilling the crude liquid vinyl acetate stream;
 - c) removing a first vapor product from the top of the first distillation tower, wherein the vapor product is predominantly a water and vinyl acetate monomer azeotrope mixture;
 - d) removing a first liquid product from the bottom of the first distillation tower, wherein the first liquid product comprises water and acetic acid;
 - e) removing a first vapor side stream from the first distillation tower, wherein the vapor side stream comprises acetic acid, water, vinyl acetate monomer and ethyl acetate,
 - f) feeding the vapor side stream from the first distillation tower into a second distillation tower;
 - g) distilling the feed in the second distillation tower;
 - h) removing a second liquid product comprising acetic acid and water from the bottom of the second distillation tower,
 - i) removing a second vapor product comprising vinyl acetate monomer, ethyl acetate and the remaining water from the top of the second distillation tower;
 - j) condensing the second vapor product; and
 - k) separating the condensed second vapor product into a vapor stream, an aqueous stream and an optional organic stream, wherein a first portion of the aqueous stream is returned to the second distillation tower as reflux and a second portion of the aqueous stream is sent to a water treatment plant or a reaction area of the vinyl acetate monomer reactor.
2. The method of claim 1, further comprising the steps of:
 - l) condensing and separating the vapor stream to form a second aqueous stream and a second organic stream,
 - m) incinerating the second organic stream, and

- n) feeding the second aqueous stream to either a water treatment plant or the reaction area of the vinyl acetate monomer reactor.
3. The method of claim 1, wherein the liquid product removed from the bottom of the first distillation tower has a constant water concentration of about 4 to 15 wt. %.
 4. The method of claim 1, wherein the first distillation tower contains 50 to 90 trays and is operated under 1 to 5 bars of absolute pressure.
 5. The method of claim 1, wherein the feed inlet tray of the first distillation tower is located between the middle section of the tower and the top of the tower.
 6. The method of claim 1, wherein the condensing of the second vapor product stream is in a temperature range of about 35 to about 105°C.
 7. The method of claim 1, wherein the optional organic stream from the condensed second vapor product is present when the condensing occurs in a temperature range of about 35 to about 78°C.
 8. A system for purifying a crude liquid vinyl acetate monomer feed, said system comprising:
 - a) a first distillation tower having a crude liquid vinyl acetate monomer feed located between the middle section of the first distillation tower and the top of the first distillation tower, wherein the feed is connected to the outlet of a vinyl acetate monomer reactor, wherein the first distillation tower is fluidly connected to a first condenser and a first phase separator, said first distillation tower further comprising:
 - i) a top outlet for release of a first vapor product comprising a predominantly vinyl acetate monomer and water azeotrope composition, wherein the first vapor product is condensed by the first condenser and separated by the first phase separator into a first aqueous stream, a first organic stream, and a first gas stream;
 - ii) a bottom outlet for release of a first liquid product comprising acetic acid and water, wherein the first liquid product is recycled to the vinyl acetate monomer reactor or a reaction area of vinyl acetate monomer reactor;
 - iii) a side outlet for release of a side vapor product comprising ethyl acetate, vinyl acetate monomer, water and acetic acid; and,
 - b) a second distillation tower with an inlet for receiving the side vapor product, wherein the second distillation tower is fluidly connected to a second condenser and phase separator, said second distillation tower further comprising:

i) a top outlet for release of a second vapor product comprising ethyl acetate, vinyl acetate monomer, and water, wherein said second vapor product is condensed and separated by the second condenser and the second phase separator into a second aqueous stream, a second gas stream, and an optional second organic stream, wherein the temperature of the second condenser affects the purity of the second aqueous stream and/or the presence of the optional second organic stream;

ii) a bottom outlet for release of a second liquid comprising acetic acid and water, wherein the second liquid is recycled to a vinyl acetate monomer reactor or reaction area of vinyl acetate monomer reactor.

9. The system of claim 8, wherein the crude liquid vinyl acetate feed comprises vinyl acetate monomer, acetic acid, water, and ethyl acetate.
10. The system of claim 8, wherein the first aqueous stream comprises vinyl acetate monomer, water and minor amounts of ethyl acetate, the first organic stream comprises vinyl acetate monomer and water, and the first gas stream comprises vinyl acetate monomer and water.
11. The system of claim 8, wherein the first liquid product of the first distillation tower has a constant water concentration of about 4 to 15 wt. %.
12. The system of claim 8, wherein a partial amount of the first organic stream is recycled to the first distillation tower as a reflux.
13. The system of claim 12, wherein the reflux of the first distillation tower has a ratio of vinyl acetate monomer recycled to vinyl acetate monomer removed between 2.0 to 4.5.
14. The system of claim 8, wherein the second aqueous stream comprises vinyl acetate monomer, water and minor amounts of ethyl acetate, the second optional organic stream comprises vinyl acetate monomer, ethyl acetate and minor amounts of water, and the second gas stream comprises vinyl acetate monomer, ethyl acetate, and water.
15. The system of claim 8, wherein the first distillation tower contains 50 to 90 trays and is operated under 1 to 5 bars of absolute pressure.
16. The system of claim 8, wherein the operational pressure of the second distillation tower is slightly below the pressure of the side outlet in the first distillation tower.
17. The system of claim 14, wherein the second aqueous stream has a high water purity and is recycled to the vinyl acetate reactor when the second condenser and phase separator are operated at temperatures between about 79 to about 120°C.
18. The system of claim 14, wherein the second aqueous stream has a low water purity and is

recycled as a reflux stream to the second distillation tower when the second condenser and phase separator are operated at temperatures between about 30 to about 78°C.

19. The system of claim 8, further comprising a third condenser and third phase separator fluidly connected to the second phase separator, wherein the third condenser and third phase separator further condense and purify the second gas stream.
20. The method of claim 8, wherein the optional second organic stream is present when the condensing occurs in a temperature range of about 35 to about 78°C.

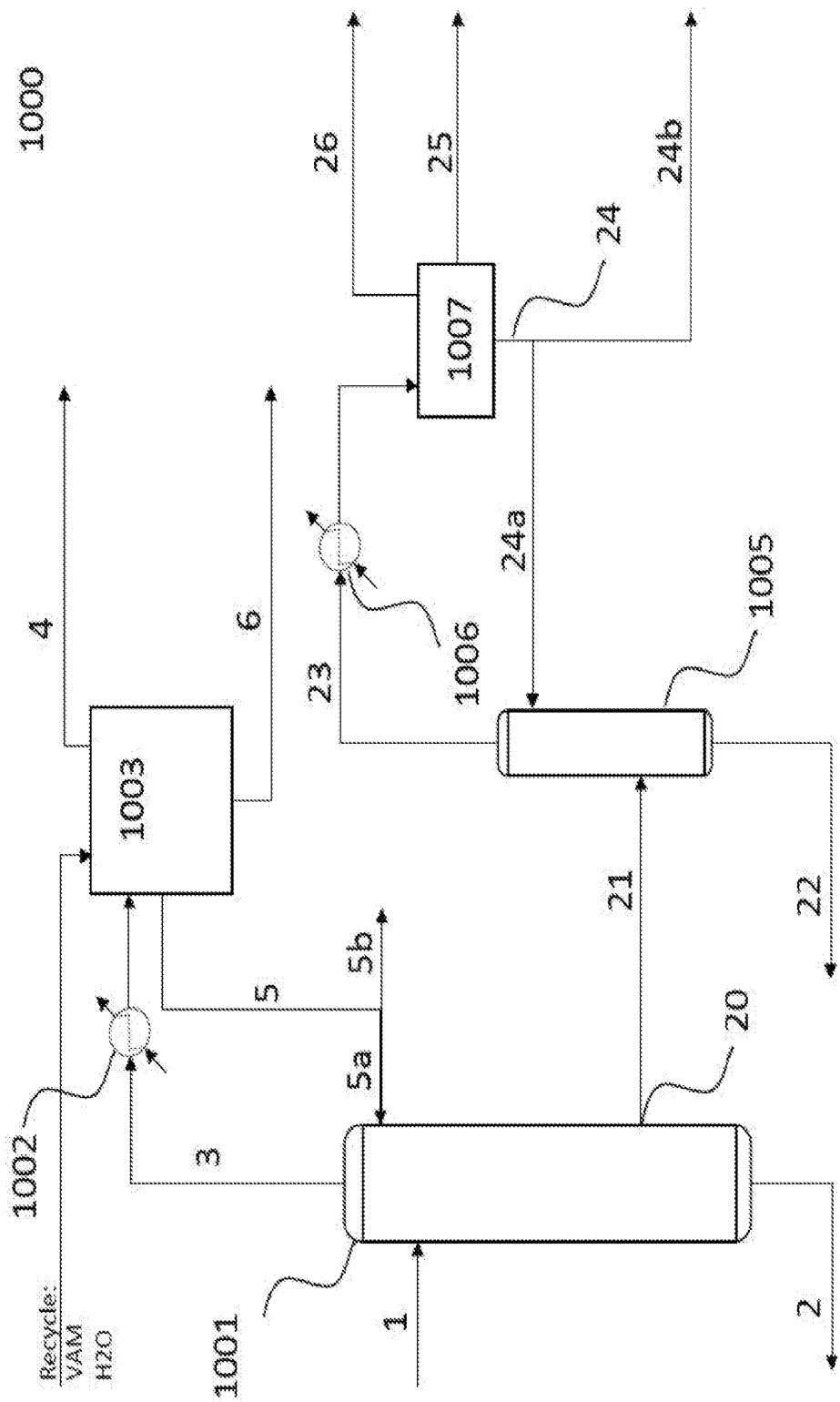


Figure 1

