CLAIMS

1. A process for the distillation of an aldehyde mixture comprising a straight-chain aldehyde and a branched-chain aldehyde wherein the process comprises:
   i) supplying a feed comprising the aldehyde mixture to a first separation vessel;
   ii) operating said first separation vessel at a first temperature and a first pressure such that separation occurs;
   iii) recovering a first stream comprising the straight-chain aldehyde from said first separation vessel and supplying said first stream to a second separation vessel;
   iv) operating said second separation vessel at a second temperature and a second pressure such that separation occurs;
   v) recovering a product stream comprising the straight-chain aldehyde and a second stream comprising high-boiling components from said second separation vessel, and supplying said second stream to a third separation vessel;
   vi) operating said third separation vessel at a third temperature and a third pressure such that separation occurs; and
   vii) recovering a third stream comprising the aldehyde mixture from said third separation vessel and reintroducing said third stream to the first separation vessel.

2. The process according to Claim 1, wherein the feed comprises: straight-chain and branched-chain C_4 aldehydes; or straight-chain and branched-chain C_5 aldehydes.

3. The process according to any one of Claims 1 and 2, wherein the first separation vessel, the second separation vessel or the third separation vessel are each individually a distillation column, for example a tray column or a packed column.

4. The process according to any one of Claims 1 to 3, wherein the temperature of a lower portion of any one of the first, second or third separation vessels is from about 200°C to about 65°C, from about 125°C to about 85°C, from about 120°C to about 90°C, from about 115°C to about 95°C; or from about 110°C to about 100°C.

5. The process according to any one of Claims 1 to 4, wherein the pressure of any one of the first, second or third separation vessels is selected from about 1.0 to about 2.4 bara, from about 1.2 to about 2.2 bara, or from about 1.4 to about 2.0 bara.

6. The process according to any one of Claims 1 to 5, wherein the first separation vessel is a tray column, optionally wherein the number of trays in the tray column is from about 40 to about 160; or from about 50 to about 150; or from about 60 to about 140; or from about 70 to about 130; or from about 80 to about 120.

7. The process according to Claim 6, wherein the feed is supplied to the first separation vessel at from about trays 5 to 100, or at from about trays 10 to 90 as counted from the top of the column.

8. The process according to any one of Claims 1 to 7, wherein the second separation vessel is a tray column, optionally wherein the number of trays in the tray column is from about 2 to about 100, from about 2 to about 50, from about 3 to about 25, from about 4 to about 20, from about 4 to about 15, or from about 4 to about 10.

9. The process according to Claim 8, wherein the first stream is supplied to the second separation vessel at a tray from 1 to 10 above the bottom of the column, from about 2 to 9 above the bottom of the column, from about 3 to 7 above the bottom of the column.

10. The process according to any one of Claims 1 to 9, wherein the third separation vessel is a tray column, optionally wherein the number of trays in the tray column is from: about 2 to about 100, from about 2 to about 50, from about 3 to about 25, from about 4 to about 20, from about 4 to about 15, or from about 4 to about 10.

11. The process according to Claim 10, wherein the second stream is supplied to the second separation vessel at a tray from 1 to 10 above the bottom of the column, from about 2 to 9 above the bottom of the column, from about 3 to 7 above the bottom of the column.

12. The process according to any one of Claims 1 to 11, wherein the first, second or third separation vessels each individually further comprises any one of the following: a reboiler, a condenser, a reboiler and condenser, a reflux drum, a reflux pump or a reflux drum and a reflux pump.

13. The process according to any one of Claims 1 to 12, wherein the first and second separation vessels are tray columns, and the number of trays in the second separation vessel is less than the number of trays present in the first separation vessel.

14. The process according to any one of Claims 1 to 13, wherein the first and third separation vessels are tray columns, and the number of trays in the third separation vessel is less than the number of trays present in the first separation vessel.

15. The process according to any one of Claims 1 to 14, wherein the first, second and third separation vessels are tray columns, and the number of trays in the second and third separation vessels is less than the number of trays present in the first separation vessel.

16. The process according to any one of Claims 1 to 9, wherein the third separation vessel is a partial vaporiser, wherein the vessel does not comprise any trays and it does not comprise a condenser, optionally the partial vaporiser is selected from a single kettle-type reboiler or vaporiser, or a vessel with an external reboiler.