Claims

1. A process for separating heavy by-products and catalyst ligand from a vapour stream comprising aldehyde, the heavy by-products and the catalyst ligand, the process comprising: passing the vapour stream to a fractionator in which the vapour stream is contacted with liquid aldehyde which removes at least a portion of the catalyst ligand and at least a portion of the heavy by-products from the vapour stream; recovering a liquid bottom stream, comprising removed catalyst ligand, removed heavy by-products and some of the aldehyde, from the fractionator; recovering a scrubbed vapour stream from the fractionator; condensing a first portion of the scrubbed vapour stream to create the liquid aldehyde, for reflux back to the fractionator; and recovering a second portion of the scrubbed vapour stream as a product aldehyde stream, wherein the liquid bottom stream is passed to a separation system to separate at least some aldehyde from the liquid bottom stream to create a recovered aldehyde stream, comprising the separated aldehyde, and a waste stream comprising the removed catalyst ligand and the removed heavy by-products.

2. A process according to claim 1 wherein the temperature at the bottom of the fractionator is not more than 140°C.

3. A process according to claim 1 or claim 2, wherein the separation system comprises a distillation column.

4. A process according to claim 3 wherein the temperature at the bottom of the distillation column is greater than the temperature at the bottom of the fractionator.

5. A process according to claim 3 or claim 4, wherein the pressure in the distillation column is lower than the pressure in the fractionator.

6. A process according to any of claims 3 to 5, wherein the distillation column is operated such that the temperature at the bottom of the distillation column is not more than 140°C.

7. A process according to any preceding claim, wherein the fractionator includes a reboiler.

8. A process according to claim 7, wherein the reboiler is operated such that the temperature at the bottom of the fractionator is at least 90°C.

9. A process according to any preceding claim, wherein the liquid bottom stream comprises at least 50 wt% aldehyde.

10. A process according to any preceding claim wherein the recovered aldehyde stream is recycled to a point in the process upstream of the fractionator.

11. A process according to any preceding claim, wherein the catalyst ligand comprises an organophosphorus ligand.

12. A process according to any preceding claim, wherein the catalyst ligand comprises triphenylphosphine.

13. A process according to any preceding claim, wherein the catalyst ligand has a vapour pressure of at least 0.01 mbar at 160°C.

14. A process according to any preceding claim, wherein the aldehyde is a C_3 to C_6 aldehyde.

15. A process according to any preceding claim, wherein the process further comprises forming the vapour stream by passing a liquid output stream from a hydroformylation process, the liquid output stream comprising the aldehyde, catalyst, the catalyst ligand and the heavy by-products, to a separator and recovering the vapour stream from the separator.

16. A process according to claim 15, wherein the hydroformylation process comprises feeding catalyst, the catalyst ligand, olefins and carbon monoxide to one or more hydroformylation reactors; reacting the olefins with the carbon monoxide to form the aldehyde and the heavy by-products; and recovering the liquid output stream comprising the aldehyde, the catalyst, the catalyst ligand and the heavy by-products.

17. A process according to any preceding claim, wherein the process further comprises passing the aldehyde in the aldehyde product stream to one or more reactors for: hydrogenation of the aldehyde to produce an aliphatic alcohol; amination of the aldehyde to produce an aliphatic amine; oxidation of the aldehyde to produce an aliphatic acid; aldol condensation of the aldehyde to produce an acrolein; or aldol condensation of the

aldehyde to produce an acrolein followed by hydrogenation of the acrolein to an aliphatic alcohol.

18. A process according to claim 17, wherein the process comprises passing the aldehyde in the aldehyde product stream to one or more reactors for: liquid phase hydrogenation of the aldehyde to produce an aliphatic alcohol; or aldol condensation of the aldehyde to produce an acrolein followed by liquid phase hydrogenation of the acrolein to an aliphatic alcohol.

19. A process according to claim 17 or claim 18, wherein the process comprises purifying the aliphatic alcohol, aliphatic amine, aliphatic acid, or acrolein.