

Claims

1. A process for preparing propylene oxide, comprising
 - (i) providing a stream comprising propene, hydrogen peroxide or a source of hydrogen peroxide, water, and an organic solvent;
 - (ii) passing the liquid feed stream provided in (i) into an epoxidation zone comprising an epoxidation catalyst comprising a titanium zeolite, and subjecting the liquid feed stream to epoxidation reaction conditions in the epoxidation zone, obtaining a reaction mixture comprising propene, propylene oxide, water, and the organic solvent;
 - (iii) removing an effluent stream from the epoxidation zone, the effluent stream comprising propylene oxide, water, organic solvent, and propene;
 - (iv) separating propene from the effluent stream by distillation, comprising
 - (iv.1) subjecting the effluent stream to distillation conditions in a distillation unit, obtaining a gaseous top stream S0 enriched in propene compared to the effluent stream subjected to distillation conditions, and a liquid bottoms stream S01 enriched in propylene oxide, water and organic solvent compared to the effluent stream subjected to distillation conditions;
 - (iv.2) returning a condensed portion of the stream S0 to an upper part of the distillation unit.
2. The process of claim 1, comprising
 - (i) providing a stream comprising propene, propane, hydrogen peroxide or a source of hydrogen peroxide, water, and an organic solvent;
 - (ii) passing the liquid feed stream provided in (i) into an epoxidation zone comprising an epoxidation catalyst comprising a titanium zeolite, and subjecting the liquid feed stream to epoxidation reaction conditions in the epoxidation zone, obtaining a reaction mixture comprising propene, propane, propylene oxide, water, and the organic solvent;
 - (iii) removing an effluent stream from the epoxidation zone, the effluent stream comprising propylene oxide, water, organic solvent, propene, and propane;
 - (iv) separating propene and propane from the effluent stream by distillation, comprising
 - (iv.1) subjecting the effluent stream to distillation conditions in a distillation unit, obtaining a gaseous top stream S0 enriched in propene and propane compared to the effluent stream subjected to distillation conditions, and a liquid bottoms stream S01 enriched in propylene oxide, water and organic solvent compared to the effluent stream subjected to distillation conditions;
 - (iv.2) returning a condensed portion of the stream S0 to an upper part of the distillation unit.
3. The process of claim 1 or 2, wherein the distillation unit employed in (iv) is at least one distillation tower, preferably one distillation tower, wherein the distillation tower has from 3

to 50, preferably from 5 to 15, more preferably from 6 to 10, more preferably from 7 to 9, theoretical trays.

4. The process of any one of claims 1 to 3, wherein the rectifying section of the distillation unit consists of from 50 to 75 %, preferably of from 60 to 65 %, of the theoretical trays and the stripping section of the distillation unit consists of from 25 to 50 %, preferably of from 35 to 40 %, of the theoretical trays.
5. The process of any one of claims 1 to 4, wherein the distillation unit employed in (iv) is operated at a top pressure of from 0.5 to 2.8 bar, preferably of from 0.6 to 2.5 bar, more preferably of from 0.8 to 1.5 bar.
6. The process of any one of claims 1 to 5, wherein the distillation unit employed in (iv) is operated at a top temperature in the range of from -70 to -30 °C, preferably of from -60 to -40 °C, more preferably of from -55 to -45 °C.
7. The process of any one of claims 1 to 6, wherein S0 removed from the distillation unit employed in (iv) has a pressure of from 0.5 to 2.8 bar, preferably of from 0.6 to 2.5 bar, more preferably of from 0.8 to 1.5 bar and a temperature in the range of from -70 to -30 °C, preferably of from -60 to -40 °C, more preferably of from -55 to -45 °C.
8. The process of any one of claims 1 to 7, wherein the portion of S0 which is condensed, resulting in a condensed portion of stream S0, is regulated so that the oxygen concentration in the uncondensed portion of the stream S0 is less than 10 vol.-%, preferably less than 7 vol.-%, most preferably less than 5 vol.-%.
9. The process of any one of claims 1 to 8, wherein condensing is achieved by compression to a pressure in the range of from 5 to 20 bar, preferably in the range of from 10 to 19 bar, more preferably in the range of from 12 to 18 bar and adjusting the temperature to be in the range of from 20 to 50 °C, preferably from 25 to 40 °C, more preferably from 32 to 38 °C.
10. The process of any one of claims 1 to 9, wherein of from 50 to 90 weight-%, preferably of from 60 to 85 weight-%, more preferably of from 65 to 80 weight-%, of S0, which form the condensed portion of S0, are returned to an upper part of the distillation unit in (iv.2).
11. The process of any one of claims 1 to 10, wherein the condensed portion of S0 is returned to an upper part of the distillation unit in (iv.2) at the top of the distillation unit or within the rectifying section of the distillation unit, preferably at the top of the distillation unit.
12. The process of any one of claims 1 to 11, wherein the condensed portion of S0, which is returned to an upper part of the distillation unit in (iv.2), has a temperature in the range of

from 20 to 50 °C, preferably in the range of from 30 to 40 °C, more preferably in the range of from 32 to 38 °C.

13. The process of any one of claims 1 to 12, wherein the condensed portion of the stream S0 is heat exchanged with stream S0 prior to the return to an upper part of the distillation unit in (iv.2).
14. The process of any one of claims 1 to 13, wherein the temperature of the condensed portion of the stream S0 is decreased after compression and prior to the return to an upper part of the distillation unit in (iv.2) by 35 to 80 K, preferably by 45 to 65 K, more preferably by 55 to 65 K.
15. The process of any one of claims 1 to 14, which is a continuous process.