# CLAIMS

1. A process for the coproduction of isobutene and high purity methanol, the process comprising:

   a. separating a feed stream comprising crude MTBE in a first fractionation system to recover an MTBE product stream comprising at least 94wt% MTBE, and to recover a heavies stream;

   b. contacting the MTBE product stream with a catalyst to provide an effluent comprising isobutene and methanol;

   c. contacting the effluent comprising isobutene and methanol with one or more extractants to produce an extractant/methanol stream and a mixed isobutene stream;

   d. feeding the mixed isobutene stream into a second fractionation system to recover a stream comprising isobutene comprising at least 95wt% isobutene and having less than 100 wppm normal C4s and less than 30 wppm C5s, and recover a stream comprising MTBE/isobutene;

   e. feeding the extractant/methanol stream into a third fractionation system to recover a lights fraction, a methanol product stream comprising at least 95wt% methanol and a heavies fraction comprising the extractant;

   f. recycling the MTBE/isobutene to the first fractionation system.

2. The process as claimed in claim 1, wherein the feed stream comprises crude MTBE provided from an etherification reaction zone and a supplemental MTBE feed stream.

3. The process as claimed in claim 2, further comprising feeding the lights fraction from the third fractionation system to the etherification reaction zone.

4. The process as claimed in claim 1, wherein the feed stream further comprises C4s, C5s, diisobutene (DIB), tertiary butyl acohol (TBA) and 2-methoxybutane (MSBE).

5. The process as claimed in claim 1, wherein the extractant comprises water.

6. The process as claimed in claim 1, wherein the third fractionation system comprises a divided wall distillation column.

7. The process as claimed in claim 1, wherein the first, second, and third fractionation systems each comprise a divided wall distillation column.

8. The process as claimed in claim 1, further comprising recycling at least a portion of the lights fraction from the third fractionation system to the first fractionation column.

9. The process as claimed in claim 1, wherein the methanol stream comprises at least 99.8 wt% methanol.

10. A process for the coproduction of isobutene and high purity methanol, the process comprising:

    a. separating a feed stream comprising crude MTBE in a first fractionation system to recover an MTBE product stream comprising at least 94wt% MTBE, and to recover a heavies stream;

    b. contacting the MTBE product stream with a catalyst to provide an effluent comprising isobutene and methanol;

    c. contacting the effluent with one or more extractants to produce an extractant/methanol stream and a mixed isobutene stream;

    d. feeding the mixed isobutene stream into a second fractionation system to recover a stream comprising isobutene comprising at least 95wt% isobutene and having less than 100 wppm normal C4s and less than 30 wppm C5s, and recover a stream comprising MTBE/isobutene;

e. feeding the extractant/methanol stream into a third fractionation system comprising a divided wall distillation column to recover an overheads fraction, a methanol side draw product stream comprising at least 95wt% methanol and a bottoms stream comprising the extractant;

f. recycling the MTBE/isobutene to the first fractionation system.

11. The process as claimed in claim ~~13~~10, further comprising recycling at least a portion of the lights fraction from the third fractionation system to the first fractionation column.

~~12. A system for the production of isobutene, the system comprising:~~

~~a. a first fractionation system (5) configured for receiving a feed stream (1) comprising crude MTBE, and for producing an MTBE product (3) stream comprising at least 94wt% MTBE and a heavies stream (4);~~

~~b. a first reactor (6) configured for contacting the MTBE product stream with a catalyst to provide an effluent (7) comprising isobutene and methanol;~~

~~c. an extraction unit (2) configured for contacting the effluent comprising isobutene and methanol with one or more extractants (9) to produce an extractant/methanol stream (11) and a mixed isobutene stream (10);~~

~~d. a second fractionation system (12) configured for receiving the mixed isobutene stream, and for producing a stream comprising isobutene (16) comprising at least 95wt% isobutene and having less than 100 wppm normal C4s and less than 30 wppm C5s, and for producing a stream comprising MTBE/isobutene (15);~~

~~e. a third fractionation system (13) configured for receiving the extractant/methanol stream, and for producing a methanol stream (17) comprising at least 95wt% methanol, a lights fraction (19), and a heavies fraction (18) comprising extractant;~~

f. a recycle line for recycling the MTBE/isobutene to the first fractionation system.

13. The system as claimed in claim 12, configured for receiving a feed stream further comprising, C4s, C5s, diisobutene (DIB), tertiary butyl acohol (TBA) and 2-methoxybutane (MSBE).

14. The system as claimed in claim 12, wherein the third fractionation system comprises at least two fractionation columns operated in series.

15. The system as claimed in claim 12, wherein the third fractionation column comprises a divided wall column comprising:

at least two vertical distillation sections;

at least one wall separating the at least two vertical distillation sections, the wall extending through a vertical portion of said distillation column, said vertical portion comprising less than the total height of said column and said sections having a common stripping section below said at least two vertical distillation sections and being in fluid communication around a bottom vertical terminus of said wall.

16.12. A process for the coproduction of isobutene and high purity methanol, the process comprising:

a. separating a feed stream comprising crude MTBE, C4s, C5s, diisobutene (DIB), tertiary butyl acohol (TBA) and 2-methoxybutane (MSBE) in a first fractionation system to recover an MTBE product stream comprising at least 94wt% MTBE, and to recover a heavies stream comprising a mixture of MTBE, tert-butyl alcohol (TBA), and 2-methoxybutane (MSBE);

b. contacting the MTBE product stream with a catalyst to provide an effluent comprising isobutene, methanol, and residual MTBE;

c. contacting the effluent with one or more extractants to produce an extractant/methanol stream and a mixed isobutene/MTBE stream;

d. feeding the mixed isobutene/MTBE stream into a second fractionation system to recover a stream comprising isobutene comprising at least 94wt% isobutene and having less than 100 wppm normal C4s and less than 30 wppm C5s, and a heavies stream comprising MTBE/isobutene;

e. recycling the heavies stream comprising MTBE/isobutene to the first fractionation system;

f. feeding the extractant/methanol stream into a third fractionation system comprising a divided wall distillation column to recover an overheads fraction, a methanol side draw product stream comprising at least 95wt% methanol and a bottoms stream comprising residual MTBE, methanol, and the extractant; and

g. recycling the bottoms stream comprising residual MTBE, methanol, and the extractant to the first fractionation system.