CLAIMS

~~What is claimed is:~~

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;

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

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

4. The process as claimed in ~~of~~ 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 ~~of~~ claim 1, wherein the extractant comprises water.

~~6. The process of claim 1, wherein the isobutene stream has less than 100 wppm normal C4s and less than 30 wppm C5s.~~

~~7.~~6. The process as claimed in ~~of~~ claim 1, wherein the third fractionation system comprises a divided wall distillation column.

~~8.~~7. The process as claimed in ~~of~~ claim 1, wherein the first, second, and third fractionation systems each comprise a divided wall distillation column.

~~9. The process of claim 1, further comprising removing a stream comprising MTBE/isobutene from the second fractionation system.~~

~~10. The process of claim 9, further comprising recycling the MTBE/isobutene to the first fractionation system.~~

~~11.~~8. The process as claimed in ~~of~~ claim 1, further comprising recycling at least a portion of the lights fraction from the third fractionation system to the first fractionation column.

~~12.~~9. The process as claimed in ~~of~~ claim 1, wherein the methanol stream comprises at least 99.8 wt% methanol.

~~13.~~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;

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

~~14. The process of claim 13, further comprising removing a stream comprising MTBE/isobutene from the second fractionation system.~~

~~15. The process of claim 14, further comprising recycling the MTBE/isobutene to the first fractionation system.~~

~~16.~~11. The process as claimed in ~~of~~ claim 13, further comprising recycling at least a portion of the lights fraction from the third fractionation system to the first fractionation column.

~~17.~~12. A system for the production of isobutene, the ~~process~~ system comprising:

a. a first fractionation system (5) ~~which~~ configured for receiving~~s~~ a feed stream (1) comprising crude MTBE, and ~~which~~ for producing~~s~~ 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) ~~which~~ configured for receiving~~es~~ the mixed isobutene stream, and ~~which~~ for producing~~es~~ 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) ~~which~~ configured for receive~~ings~~ the extractant/methanol stream, and for ~~which~~ producing~~es~~ a methanol stream (17) comprising at least 95wt% methanol, a lights fraction (19), and a heavies fraction (18) comprising extractant;

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

~~18.~~13. The system ~~of~~ as claimed in claim ~~15~~12, ~~where~~ configured for receiving a~~in the~~ feed stream further comprising~~es~~, C4s, C5s, diisobutene (DIB), tertiary butyl acohol (TBA) and 2-methoxybutane (MSBE).

~~19.~~14. The system as claimed in ~~of~~ claim ~~15~~12, wherein the third fractionation system comprises at least two fractionation columns operated in series.

~~20.~~15. The system as claimed in ~~of~~ claim ~~15~~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.

~~21.~~16. 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.