[0032] In splitter 30, the isobutane and the isobutylene are separated via conventional distillation. Typical splitter 30 operating conditions may include an overhead temperature in the range from 22°C to 55°C, such as from about 37°C to about 45°C, and overhead pressures in the range from about 3 bara to about 7 bara, such as from about 5 bara to about 6 bara. Bottoms temperatures in the splitter may range from about 35°C to about 65°C, such as from about 50°C to about 60°C. Splitter 30 may contain enough trays to effect the desired separation, allowing a recovery of an on overhead fraction 32 containing isobutane and a bottoms fraction 34 containing isobutylene.

[0033] The overheads 32 may be condensed in a condenser 36 and collected in a receiver separator 38. Overheads 32 may contain primarily isobutane, but may contain some isobutylene and other light components. Components lighter than isobutane, if present, may be vented via flow line 40. A portion of the condensed overhead product collected in receiver separator 38 may be recycled via flow line 42 to splitter 30 as a reflux. The isobutane may be recovered as an overheads product via flow line 44.

[0034] In embodiments herein, the overhead temperature of catalytic distillation column 10 is maintained at a higher temperature than the bottoms temperature of distillation column 30. Heat may thus be supplied to splitter 30 reboiler 50 via indirect heat exchange with overhead stream 16. A flow line 52 may be used to route all or a portion of overhead stream 16 to reboiler 50, cooling and in some embodiments partially condensing the overhead components in stream 52 via indirect heat exchange with a portion 60 of bottoms stream 34. The resulting cooled overhead stream(s) 62 may then be returned to condenser 18~~36~~ and/or receiver 20~~38~~ for further condensation, cooling, and recovery, as described above.

[0035] Additional heat may be supplied, as necessary, to the bottoms of splitter 30 by an additional reboiler 70. Reboiler 70 may be used to heat a second portion of bottoms stream 34, for example, via indirect heat exchange with all or a portion of the distillation column bottoms stream 14, the cooled heat exchange medium 80 resulting from catalytic distillation column reboiler 82, or other available heat sources. A bottoms product, comprising high purity isobutylene, may be recovered via flow line 72.

CLAIMS

What is claimed:

1. A process for the production of high purity isobutylene, comprising:

supplying a mixed C4 feed stream, comprising isobutylene, isobutane, and 1-butene, and optionally comprising one or more of butadiene, 2-butene, or n-butanes, to a catalytic distillation column containing a butene isomerization catalyst;

in the catalytic distillation column, concurrently isomerizing 1-butene to 2-butene and separating the 2-butene from the isobutane and isobutylene;

recovering the 2-butene from the catalytic distillation column as a bottoms stream;

recovering an overheads fraction comprising the isobutane and isobutylene from the catalytic distillation column;

condensing the overheads fraction comprising the isobutane and isobutylene in an overheads system;

feeding at least a portion of the condensed overheads fraction to a splitter and separating the isobutane from the isobutylene in the splitter;

recovering a bottoms stream from the splitter comprising the isobutylene; and

recovering an overheads stream from the splitter comprising the isobutane;

wherein the process further comprises:

operating the catalytic distillation column at an overheads temperature greater than a bottoms temperature of the splitter; and

heating a portion of the splitter bottoms stream via indirect heat exchange with at least a portion of the catalytic distillation column overheads fraction, producing a heated bottoms stream fed to a lower portion of the splitter and a cooled overheads fraction; and

feeding the cooled overheads stream via at least one flow line to the overheads system.

2. The process of claim 1, further comprising an accumulator for receiving the cooled overheads stream, and wherein the at least one flow line for feeding the cooled overheads stream to the overheads system comprises a first flow line and a second flow line, the process further comprising:

feeding a vapor portion of the cooled overhead stream via the first flow line from the accumulator to the overheads system; and

feeding a liquid portion of the cooled overhead stream via the second flow line from the accumulator to the overheads system.

3. The process of claim 1, further comprising:

heating a second portion of the splitter bottoms stream via indirect heat exchange with at least a portion of the catalytic distillation column bottoms fraction, producing a heated splitter bottoms stream fed to a lower portion of the splitter and a cooled 2-butene fraction.

4. The process of claim 1, wherein the catalytic distillation column is operated at an overheads temperature in the range from about 42°C to about 138°C.

5. The process of claim 1, wherein the catalytic distillation column is operated at an overheads temperature in the range from about 85°C to about 138°C.

6. The process of claim 1, wherein the catalytic distillation column is operated at an overheads temperature in the range from about 60°C to about 65°C.

7. A process for the production of high purity isobutylene, comprising:

supplying a mixed C4 feed stream, comprising isobutylene, isobutane, and 1-butene, and optionally comprising one or more of butadiene, 2-butene, or n-butanes, to a catalytic distillation column containing a butene isomerization catalyst;

in the catalytic distillation column, concurrently isomerizing 1-butene to 2-butene and separating the 2-butene from the isobutane and isobutylene;

recovering the 2-butene from the catalytic distillation column as a bottoms stream;

recovering an overheads fraction comprising the isobutane and isobutylene from the catalytic distillation column;

condensing the overheads fraction comprising the isobutane and isobutylene in an overheads system;

feeding at least a portion of the condensed overheads fraction to a splitter and separating the isobutane from the isobutylene in the splitter;

recovering a bottoms stream from the splitter comprising the isobutylene; and

recovering an overheads stream from the splitter comprising the isobutane;

wherein the process further comprises:

operating the catalytic distillation column at an overheads temperature ~~or~~ of greater than 60°C;

operating the splitter at a bottoms temperature of less than 55°C; and

heating a portion of the splitter bottoms stream via indirect heat exchange with at least a portion of the catalytic distillation column overheads fraction, producing a heated bottoms stream fed to a lower portion of the splitter and a cooled overheads fraction; and

feeding the cooled overheads stream via at least one flow line to the overheads system.

8. The process of claim 7, further comprising an accumulator for receiving the cooled overheads stream, and wherein the at least one flow line for feeding the cooled overheads stream to the overheads system comprises a first flow line and a second flow line, the process further comprising:

feeding a vapor portion of the cooled overhead stream via the first flow line from the accumulator to the overheads system; and

feeding a liquid portion of the cooled overhead stream via the second flow line from the accumulator to the overheads system.

9. The process of claim 7, further comprising:

heating a second portion of the splitter bottoms stream via indirect heat exchange with at least a portion of the catalytic distillation column bottoms fraction, producing a heated splitter bottoms stream fed to a lower portion of the splitter and a cooled 2-butene fraction.

10. The process of claim 7, wherein the catalytic distillation column is operated at an overheads temperature ~~or~~ of greater than 85°C

11. A system for the production of high purity isobutylene, comprising:

a feed stream for supplying a mixed C4 stream comprising isobutylene, isobutane, and 1-butene, and optionally comprising one or more of butadiene, 2-butene, or n-butanes;

a catalytic distillation column containing a butene isomerization catalyst, the catalytic distillation column configured to operate at a temperature of greater than 85°C and to concurrently isomerize 1-butene to 2-butene and separate the 2-butene from the isobutane and isobutylene;

a bottoms stream for recovering the 2-butene from the catalytic distillation column;

an overheads stream for recovering an overheads fraction comprising the isobutane and isobutylene from the catalytic distillation column;

an overheads system for condensing the overheads fraction comprising the isobutane and isobutylene;

a splitter for receiving at least a portion of the condensed overheads fraction and for separating the isobutane from the isobutylene;

a stream for recovering the isobutylene as a bottoms from the splitter; and

a stream for recovering the isobutane as an overheads from the splitter.

12. The system of claim 11, wherein the system is configured to operate with a catalytic distillation column overheads temperature greater than a bottoms temperature of the splitter.

13. The system of claim 12, further comprising:

a reboiler configured to heat a portion of the isobutylene bottoms via indirect heat exchange with at least a portion of the overheads stream, producing a heated bottoms stream fed to a lower portion of the splitter and a partially condensed overheads stream; and

at least one flow line for feeding the partially condensed overheads stream to the overheads system.

14. The system of claim 13, further comprising an accumulator for receiving the partially condensed overheads stream, and wherein the at least one flow line for feeding the partially condensed overheads stream to the overheads system comprises:

a first flow line for feeding a vapor portion of the partially condensed overhead stream from the accumulator to the overheads system; and

a second flow line for feeding a liquid portion of the partially condensed overhead stream from the accumulator to the overheads system.

15. The system of claim 13, further comprising a reboiler configured to heat a portion of the isobutylene bottoms via indirect heat exchange with at least a portion of the bottoms stream, producing a heated bottoms stream fed to a lower portion of the splitter and a cooled 2-butene stream.