Claims

1. A process for obtaining isobutene from an isobutene containing C4-hydrocarbon mixture (1) in a plant comprising an etherification unit (3), a first distillation unit (5), an ether cleavage unit (10) and a second distillation unit (12), the process comprising:

(a) contacting the C4-hydrocarbon mixture (1) with a primary alcohol or isopropyl alcohol (2) and reacting the mixture with the primary alcohol or isopropyl alcohol in the presence of an acidic catalyst to form the corresponding alkyl tert-butyl ether in the etherification unit (3);

(b) distilling the reaction mixture (4) from the etherification unit (3) in the first distillation unit (5), a C4-hydrocarbon raffinate being withdrawn as the overhead product (6), and the alkyl tert-butyl ether being withdrawn as the bottom product (7);

(c) vaporizing the bottom product from the first distillation unit (5) in an evaporator (8) obtaining a vapor stream (9);

(d) reacting the vapor stream (9) of step (c) in the presence of an acidic catalyst obtaining isobutene and the primary alcohol or isopropyl alcohol as reaction products in the ether cleavage unit (10);

(e) distilling the reaction mixture (11) from the ether cleavage unit (10) in the second distillation unit (12), isobutene being withdrawn as the overhead product (13), the primary alcohol or isopropyl alcohol being withdrawn as the bottom product (14) and being recycled to the etherification unit (3);

characterized in that a purge stream (15) containing high boiling components with a normal boiling point higher than that of the alkyl tert-butyl ether is withdrawn from the evaporator (8) in step (c).

2. The process according to claim 1, wherein the plant further comprises a byproduct separation unit (17) being fed by a part of the bottom product of the second distillation unit (12), wherein an alcohol product stream rich in the primary alcohol or isopropyl alcohol is separated from this feed stream.

3. The process according to claim 2, wherein the primary alcohol or isopropyl alcohol is recycled to the etherification unit.

4. The process according to claim 2 or 3, wherein the purge stream (15) from the evaporator in step (c) is fed to the byproduct separation unit (17).

5. The process according to any one of claims 2 to 4, wherein alkyl tert-butyl ether contained in the bottom product stream from the second distillation unit (12) is separated in the byproduct purification unit (17) and is recycled to the evaporator (8) of step (c) for evaporation and/or to the ether cleavage unit (10).

6. The process according to any one of claims 2 to 5, wherein the bottom product of the second distillation unit (12) fed to the byproduct separation unit (17) is split up in at least three byproduct streams wherein a first byproduct stream (18) is rich in diisobutene, a second byproduct stream (19) is the alcohol product stream rich in the primary alcohol or isopropyl alcohol, and a third byproduct stream (20) is rich in components with a normal boiling point higher than 110°C.

7. The process according to any one of claims 2 to 6, wherein the mass fraction of the primary alcohol or isopropyl alcohol in the alcohol product stream is at least 90 wt.-%, preferably at least 95 wt.-%.

8. The process according to claims 6 or 7, wherein the first byproduct stream (18) is further split up in at least two further byproduct streams wherein a fourth byproduct stream (21) is rich in diisobutene and a fifth byproduct stream (22) is rich in alkyl tert-butyl ether.

9. The process according to claim 8, wherein the mass fraction of diisobutene in the first byproduct stream (18) is at least 30 wt.-% and the mass fraction of diisobutene in the fourth byproduct stream (21) is at least 90 wt.-%, preferably at least 95 wt.-%, more preferably at least 98 wt.-%, in particular at least 99 wt.-%.

10. The process according to any one of claims 1 to 9, wherein the first distillation unit (5) comprises a distillation column, the bottom product (7) being withdrawn as a side stream from the distillation column at a stage below the feed stage, and a purge stream (23) rich in high-boiling components being withdrawn from the sump of the distillation column.

11. The process according to claim 10, wherein the purge stream (23) from the sump of the distillation column in the first distillation unit (5) is fed to the byproduct separation unit (17).

12. The process according to any one of claims 8 to 11, wherein the fifth byproduct stream (22) is at least partly recycled to the evaporator (8) for evaporation and/or to the ether cleavage unit (10).

13. The process according to any one of claims 1 to 12, wherein the evaporator (8) is a natural circulation evaporator, particularly a Robert type evaporator, and wherein the purge stream (15) is withdrawn from the liquid phase in the bottom of the evaporator (8).

14. The process according to any one of claims 1 to 13, wherein the primary alcohol is isobutanol, and the alkyl tert-butyl ether is isobutyl tert-butyl ether (IBTBE).