Claims

1. A process for continuously preparing polyisobutylene having a content of terminal double bonds of more than 50% by polymerizing isobutene in the presence of a polymerization catalyst customary therefor, which comprises combining a technical 1-butene-, 2-butene- and isobutene-containing C_4 hydrocarbon stream which may comprise up to 3000 ppm by weight of 1,3-butadiene, which type of technical C_4 hydrocarbon stream is supplied as a composition which changes as the isobutene content changes over the course of time, together with a stream of pure isobutene and feeding them into the reaction zone in such a way that the steady-state concentration of the isobutene in the combined stream at the feed point of the combined stream into the reaction zone has an average value of at least 40% by weight, and the steady-state concentration of isobutene in the combined stream at the feed point of the combined stream into the reaction zone has a substantially constant value which may vary over the course of the polymerization reaction by a maximum of 10% in the upward or downward direction, based on the mean isobutene concentration in the combined stream at the feed point.

2. The process according to claim 1, characterized in that the steady-state concentration of isobutene in the combined stream at the feed point of the combined stream into the reaction zone has an average value of 40% by weight to 60% by weight.

3. The process according to claim 1, characterized in that the steady-state concentration of the isobutene in the combined stream at the feed point of the combined stream into the reaction zone has an average value of 45% by weight to 60% by weight.

4. The process according to claim 1, wherein the steady-state concentration of isobutene in the combined stream at the feed point of the combined stream into the reaction zone has a substantially constant value which may vary over the course of the polymerization reaction by a maximum of 8% in the upward or downward direction, based on the mean isobutene concentration in the combined stream at the feed point.

5. The process according to claim 1, wherein the steady-state concentration of isobutene in the combined stream at the feed point of the combined stream into the reaction zone has a substantially constant value which may vary over the course of the polymerization reaction by a maximum of 6% in the upward or downward direction, based on the mean isobutene concentration in the combined stream at the feed point.

6. The process according to claim 1, wherein the steady-state concentration of isobutene in the combined stream at the feed point of the combined stream into the reaction zone has a substantially constant value which may vary over the course of the polymerization reaction by a maximum of 4% in the upward or downward direction, based on the mean isobutene concentration in the combined stream at the feed point.

7. The process according to claim 1, wherein the technical 1-butene-, 2-butene- and isobutene-containing C_4 hydrocarbon stream comprises less than 2000 ppm by weight of 1,3-butadiene.

8. The process according to claim 1, wherein the technical 1-butene-, 2-butene- and isobutene-containing C_4 hydrocarbon stream comprises less than 1000 ppm by weight of 1,3-butadiene.

9. The process according to claim 1, wherein the polymerization catalyst is at least one type of polymerization catalyst selected from the group consisting of boron trifluoride, boron trifluoride complexes, tin tetrachloride and aluminium chloride.

10. The process according to claim 1, wherein the polymerization catalyst is used in amounts of 0.001 to 10% by weight, based on the isobutene content of the C_4 hydrocarbon stream.

11. The process according to claim 1, wherein the isobutene polymerization is carried out at temperatures of -100 to +100°C.

12. The process according to claim 1, wherein the isobutene polymerization is carried out at temperatures of -50 to +25°C.

13. The process according to claim 1, wherein the isobutene polymerization is carried out at temperatures of -35 to +5°C.

14. The process according to claim 1, wherein the polyisobutylene has a content of terminal double bonds of at least 65%.

15. The process according to claim 1, wherein the polyisobutylene has a content of terminal double bonds of at least 75%.

16. The process according to claim 1, wherein the polyisobutylene has a content of terminal double bonds of at least 80%.

17. The process according to claim 1, wherein the polyisobutylene has a polydispersity of less than 2.5.

18. The process according to claim 1, wherein the polyisobutylene has a polydispersity of less than 2.0.

19. The process according to claim 1, wherein the polyisobutylene has a polydispersity of 1.8 or less.

20. A polymerization plant for continuously preparing polyisobutylene having a content of terminal double bonds of more than 50% by polymerizing isobutene in the presence of a polymerization catalyst customary therefor, comprising a temperature-controllable reaction zone for the performance of the polymerization reaction, feed devices and removal devices, wherein the polymerization plant comprises a feed device into the reaction zone for a combined stream of a technical 1-butene-, 2-butene- and isobutene-containing C_4 hydrocarbon stream which may comprise up to 3000 ppm by weight of 1,3-butadiene, which technical C_4 hydrocarbon stream has a composition which changes as the isobutene content changes over the course of time, and a stream of pure isobutene, and the feed device for the combined stream of the technical C_4 hydrocarbon stream and the stream of pure isobutene comprises a regulating device which ensures that the steady-state concentration of isobutene in the combined stream at the feed point of the combined stream into the reaction zone has an average value of at least 40% by weight, and ensures that the steady-state concentration of isobutene in the combined stream at the feed point of the combined stream into the reaction zone has an essentially constant value which may vary over the course of the polymerization reaction by a maximum of 10% in the upward or downward direction, based on the mean isobutene concentration in the combined stream at the feed point.