Claims

1. A liquid polybutadiene, having a number-average molecular weight of 2,500-5,500, and a molecular weight distribution index of 1-1.2, wherein based on the total amount of the liquid polybutadiene, the content of a 1,2-structural unit in the liquid polybutadiene is 85-95 wt%, and the content of a 1,4-structural unit in the liquid polybutadiene is 5-15 wt%, wherein a molar ratio of a cis-1,4-structural unit to a trans-1,4-structural unit in the liquid polybutadiene is 1-2 : 1; and the dynamic viscosity of the liquid polybutadiene at 45°C is 100-500 P.

2. The liquid polybutadiene according to claim 1, wherein the molar ratio of the cis-1,4-structural unit to the trans-1,4-structural unit in the liquid polybutadiene is 1.3-1.9 : 1, preferably 1.65-1.75 : 1.

3. The liquid polybutadiene according to claim 1 or 2, wherein the content of the 1,2-structural unit in the liquid polybutadiene is 87-94 wt%, preferably 90-93 wt% based on the total amount of the liquid polybutadiene.

4. The liquid polybutadiene according to claim 1, wherein the liquid polybutadiene has a number-average molecular weight of 2,800-5,000, preferably 3,000-4,500.

5. The liquid polybutadiene according to claim 1 or 4, wherein the liquid polybutadiene has a molecular weight distribution index of 1.01-1.09, preferably 1.02-1.06.

6. The liquid polybutadiene according to any one of claims 1 to 5, wherein the weight content of metal elements in the liquid polybutadiene is 200 ppm or less, preferably 100 ppm or less, more preferably 50 ppm or less, further preferably 20 ppm or less based on the total amount of the liquid polybutadiene.

7. The liquid polybutadiene according to any one of claims 1 to 6, wherein the liquid polybutadiene has a glass transition temperature of -32°C to -12°C, preferably -27°C to

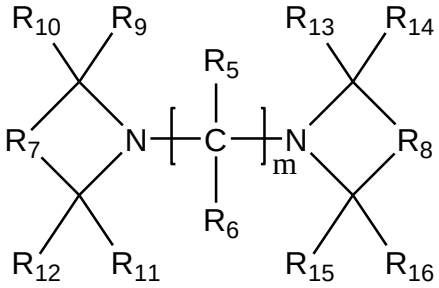
-17°C.

8. The liquid polybutadiene according to any one of claims 1 to 7, wherein the dynamic viscosity of the liquid polybutadiene at 45°C is 150-350P, preferably 170-300P, more preferably 180-250P.

9. The liquid polybutadiene according to any one of claims 1 to 3, 6 and 7, wherein the liquid polybutadiene has a number-average molecular weight of 2,500-4,000, preferably 3,000-4,000, and the dynamic viscosity of the liquid polybutadiene at 45°C is 100-280P, preferably 150-260P;
preferably, the liquid polybutadiene has a molecular weight distribution index of 1-1.05.

10. The liquid polybutadiene according to any one of claims 1 to 3, 6 and 7, wherein the liquid polybutadiene has a number-average molecular weight of greater than 4000 and not more than 5500, and the dynamic viscosity of the liquid polybutadiene at 45°C is greater than 280 P and not more than 500P, preferably 280-480P;
preferably, the liquid polybutadiene has a molecular weight distribution index of 1-1.08.

11. A preparation method for liquid polybutadiene according to claim 1, comprising contacting 1,3-butadiene with a structure modifier and an organolithium initiator in a polymerization solvent under anionic polymerization reaction conditions to obtain a polymerization reaction mixture comprising polybutadiene, wherein the contacting is carried out at a temperature of -10°C to 20°C; the structure modifier comprises a component A and a component B, wherein the component A is one or two or more selected from ethers and amines, and the component B is one or two or more selected from alkali metal alkoxides; a molar ratio of the organolithium initiator to the component A to the component B is 1 : 0.05-0.3 : 0.03-0.2; and the organolithium initiator is based on lithium;
the component A is one or two or more selected from diethylene glycol dimethyl ether, diethylene glycol diethyl ether, diethylene glycol di-n-propyl ether, diethylene glycol di-n-butyl ether and a compound shown in a formula II,



(Formula II)

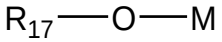
in the formula II, R_5 and R_6 are the same or different, and are each independently a hydrogen atom or C_1-C_6 alkyl,

R_7 and R_8 are the same or different, and are each independently C_1-C_6 alkylene, and R_9, R_{10}, R_{11}, R_{12}, R_{13}, R_{14}, R_{15}, and R_{16} are the same or different, and are each independently a hydrogen atom or C_1-C_6 alkyl, and

m is an integer of 1-5.

12. The method according to claim 11, wherein the component A is one or two or more selected from diethylene glycol dimethyl ether, diethylene glycol diethyl ether, diethylene glycol di-n-propyl ether, diethylene glycol di-n-butyl ether, and 1,2-dipiperidylethane.

13. The method according to claim 11 or 12, wherein the alkali metal alkoxide is one or two or more selected from compounds represented by a formula III,



(Formula III)

in the formula III, R_{17} is C_1-C_{20} alkyl, C_6-C_{30} aryl or C_4-C_{20} cycloalkyl, and

M is an alkali metal atom; and

preferably, the component B is one or two or more selected from sodium tert-butoxide, sodium tert-amylate, sodium mentholate, sodium ethoxide and sodium n-hexylate.

14. The method according to any one of claims 11 to 13, wherein the molar ratio of the organolithium initiator to the component A to the component B is 1 : 0.1-0.2 : 0.05-0.15, and the organolithium initiator is based on lithium.

15. The method according to any one of claims 11 to 14, wherein a molar ratio of the

component B to the component A is 0.4-1.5 : 1, preferably 0.5-1 : 1.

16. The method according to any one of claims 11 to 15, wherein the organolithium initiator is used in an amount such that the prepared liquid polybutadiene has a number-average molecular weight of 2,500-5,500, preferably 2,800-5,000, more preferably 3,000-4,500; preferably, the organolithium initiator is one or more selected from compounds represented by a formula IV,

$R_{18}Li$ (Formula IV)

in the formula IV, R_{18} is C_1-C_6 alkyl, C_3-C_{12} cycloalkyl, C_7-C_{14} aralkyl or C_6-C_{12} aryl; more preferably, the organolithium initiator is n-butyllithium and/or sec-butyllithium.

17. The method according to any one of claims 11 to 16, wherein the contacting is carried out at a temperature of -5°C to 10°C.

18. The method according to any one of claims 11 to 17, wherein the content of 1,3-butadiene is 1-15 wt%, preferably 4-10 wt% based on the total amount of the polymerization solvent and 1,3-butadiene.

19. A composition, comprising liquid polybutadiene and at least one additive, wherein the liquid polybutadiene is the liquid polybutadiene according to any one of claims 1 to 10.

20. The composition according to claim 19, wherein the additive comprises an antioxidant.

21. Application of the liquid polybutadiene according to any one of claims 1 to 10, or the composition according to any one of claims 19 and 20 as a crosslinking agent, an adhesive or an electrically insulating material.