Claims

1. An amine mixture comprising, as predominant components,

(A) 0.1 to 99.9 parts by weight of a polyisobuteneamine of the general formula (I)

$$PIB(CH_2)_x(OH)_m(NR^2R^3)_n \qquad (I)$$

in which

the PIB moiety is a structure derived from polybutene or polyisobutene comprising 0 to 20% by weight of n-butene or a polybutyl or polyisobutyl radical derived from isobutene and 0 to 20% by weight of n-butene,

the variables $R^2$ and $R^3$, which may be the same or different, are each hydrogen, aliphatic or aromatic hydrocarbyl radicals, primary or secondary, aromatic or aliphatic aminoalkylene radicals or polyaminoalkylene radicals, polyoxyalkylene radicals, heteroaryl or heterocyclyl radicals, or together with the nitrogen atom to which they are bonded form a ring in which further heteroatoms may be present, and

the variable x may assume the value of 0 or 1, the variable m the value of 0 or 1, and the variable n the value of 1, 2 or 3,

the polyisobuteneamine (I) having a number-average molecular weight of 300 to 2500,

and

(B) 0.1 to 99.9 parts by weight of an aliphatic amine of the general formula (II)

$$R^4\text{-}NR^2R^3 \qquad (II)$$

in which the variable $R^4$ denotes a linear or branched $C_6$- to $C_{600}$-alkyl radical

and the variables $R^2$ and $R^3$ are each as defined above,

where the sum of the parts by weight of components (A) and (B) adds up to 100 parts by weight,

obtainable by reductive amination of a mixture of corresponding parts by weight

(i) of the oxo process product formed in the hydroformylation of polybutene or polyisobutene, and of an alkanol of the formula $R^4$-OH or

(ii) of the epoxide formed in the epoxidation of polybutene or polyisobutene, and of an alkanol of the formula $R^4$-OH or

(iii) of the nitro compound which is formed in the reaction of polybutene or polyisobutene with nitrogen oxides or mixtures of nitrogen oxides and oxygen, and of an alkanol of the formula $R^4$-OH

with ammonia or an amine of the formula $HNR^2R^3$.

2. The amine mixture according to claim 1, comprising as predominant components

(A) 0.1 to 99.9 parts by weight of a polyisobuteneamine of the general formula (Ia)

$$R^1\text{-}CH_2\text{-}NR^2R^3 \qquad \text{(Ia)}$$

in which the variable $R^1$ is a polybutyl or polyisobutyl radical derived from isobutene and 0 to 20% by weight of n-butene and the variables $R^2$ and $R^3$ are each as defined above,

and

(B) 0.1 to 99.9 parts by weight of an aliphatic amine of the general formula (II),

obtainable by reductive amination of a mixture of corresponding parts by weight of the oxo process product formed in the hydroformylation of polybutene or polyisobutene, and of an alkanol of the formula $R^4$-OH with ammonia or an amine of the formula $HNR^2R^3$.

3. The amine mixture according to claim 1 or 2, comprising, as component (A), a polyisobuteneamine of the formula (I) or (Ia) having a mean molecular weight of 500 to 1500.

4. The amine mixture according to claims 1 to 3, comprising, as component (B), an aliphatic amine of the formula $R^4$-$NH_2$ in which the variable $R^4$ denotes a linear or branched $C_7$- to $C_{23}$-alkyl radical or a polybutyl or polyisobutyl radical having 24 to 600 carbon atoms.

5. The amine mixture according to any of claims 1 to 4, comprising 50 to 95 parts by weight, especially 70 to 90 parts by weight, of component (A) and 5 to 50 parts by weight, especially 10 to 30 parts by weight, of component (B), where the sum of the parts by weight of components (A) and (B) adds up to 100 parts by weight.

6. A process for preparing an amine mixture comprising, as predominant components

(A) 0.1 to 99.9 parts by weight of a polyisobuteneamine of the general formula (I)

$$PIB(CH_2)_x(OH)_m(NR^2R^3)_n \qquad (I)$$

in which

the PIB moiety is a structure derived from polybutene or polyisobutene comprising 0 to 20% by weight of n-butene or a polybutyl or polyisobutyl radical derived from isobutene and 0 to 20% by weight of n-butene,

the variables $R^2$ and $R^3$, which may be the same or different, are each hydrogen, aliphatic or aromatic hydrocarbyl radicals, primary or secondary, aromatic or aliphatic aminoalkylene radicals or polyaminoalkylene radicals, polyoxyalkylene radicals, heteroaryl or heterocyclyl radicals, or together with the nitrogen atom to which they are bonded form a ring in which further heteroatoms may be present, and

the variable x may assume the value of 0 or 1, the variable m the value of 0 or 1, and the variable n the value of 1, 2 or 3,

the polyisobuteneamine (I) having a number-average molecular weight of 300 to 2500,

and

(B) 0.1 to 99.9 parts by weight of an aliphatic amine of the general formula (II)

$$R^4\text{-}NR^2R^3 \qquad (II)$$

in which the variable $R^4$ denotes a linear or branched $C_6$- to $C_{600}$-alkyl radical

and the variables $R^2$ and $R^3$ are each as defined above,

where the sum of the parts by weight of components (A) and (B) adds up to 100 parts by weight,

which comprises reductively aminating a mixture of corresponding parts by weight

(i) of the oxo process product formed in the hydroformylation of polybutene or polyisobutene, and of an alkanol of the formula $R^4$-OH or

(ii) of the epoxide formed in the epoxidation of polybutene or polyisobutene, and of an alkanol of the formula $R^4$-OH or

(iii) of the nitro compound which is formed in the reaction of polybutene or polyisobutene with nitrogen oxides or mixtures of nitrogen oxides and oxygen, and of an alkanol of the formula $R^4$-OH

with ammonia or an amine of the formula $HNR^2R^3$.

7. An amine mixture comprising, as predominant components,

(A) 0.1 to 99.9 parts by weight of a polyisobuteneamine of the general formula (I)

$$PIB(CH_2)_x(OH)_m(NR^2R^3)_n \qquad (I)$$

in which

the PIB moiety is a structure derived from polybutene or polyisobutene comprising 0 to 20% by weight of n-butene or a polybutyl or polyisobutyl radical derived from isobutene and 0 to 20% by weight of n-butene,

the variables $R^2$ and $R^3$, which may be the same or different, are each hydrogen, aliphatic or aromatic hydrocarbyl radicals, primary or secondary, aromatic or aliphatic aminoalkylene radicals or polyaminoalkylene radicals, polyoxyalkylene radicals, heteroaryl or heterocyclyl radicals, or together with the nitrogen atom to which they are bonded form a ring in which further heteroatoms may be present, and

the variable x may assume the value of 0 or 1, the variable m the value of 0 or 1, and the variable n the value of 1, 2 or 3,

the polyisobuteneamine (I) having a number-average molecular weight of 300 to 2500,

and

(B') 0.1 to 99.9 parts by weight of an aliphatic amine of the general formula (II)

$$R^{14}\text{-}NR^2R^3 \qquad (II)$$

in which the variable $R^{14}$ denotes a linear or branched $C_6$- to $C_9$-alkyl radical and the variables $R^2$ and $R^3$ are each as defined above,

where the sum of the parts by weight of components (A) and (B') adds up to 100 parts by weight.

8. The amine mixture according to claim 7, comprising, as component (B'), an aliphatic amine of the general formula (II) in which the variable $R^{14}$ denotes a branched $C_6$- to $C_9$-alkyl radical and the variables $R^2$ and $R^3$ each denote hydrogen.

9. The amine mixture according to claim 8, comprising, as component (B'), an aliphatic amine of the general formula (II) in which the variable $R^{14}$ denotes a 2-ethylhexyl radical and the variables $R^2$ and $R^3$ each denote hydrogen.

10. The amine mixture according to claim 9, comprising, as component (A), a polyisobuteneamine of the general formula (Ia)

$$R^1\text{-}CH_2\text{-}NR^2R^3 \qquad (Ia)$$

in which the variable $R^1$ is a polybutyl or polyisobutyl radical which is derived from isobutene and 0 to 20% by weight of n-butene and has a number-average molecular weight of 300 to 2500 and the variables $R^2$ and $R^3$ each denote hydrogen, and, as component (B'), an aliphatic amine of the general formula (II) in which the variable $R^{14}$ denotes a 2-ethylhexyl radical and the variables $R^2$ and $R^3$ likewise each denote hydrogen.

11. A fuel composition comprising an amine mixture according to claims 1 to 10.

12. The fuel composition according to claim 11, which has an alcohol content of 0 to 100% by volume and is suitable for operation of gasoline engines.

13. The use of an amine mixture according to claims 1 to 10 for cleaning and keeping clean intake valves in gasoline engines with intake pipe injection, and of injection nozzles in direct injection gasoline engines.

**Claims**

1. An invention not claimed in any divisional application.