CLAIMS

1. An isoprene separation and recovery method for separating and recovering isoprene from a mixed fluid containing isoprene, comprising:

an extractive distillation step of performing extractive distillation of the mixed fluid to obtain a fraction containing an impurity having lower solubility than isoprene in an extractant used in the extractive distillation and a fraction containing crude isoprene; and

a dividing wall distillation step of performing dividing wall distillation of the fraction containing crude isoprene to obtain a fraction (F) containing an impurity having a higher boiling point than isoprene, a fraction (E) containing an impurity having a lower boiling point than isoprene, and a fraction (G) containing high-purity isoprene, wherein

the mixed fluid further contains at least one selected from the group consisting of pentane, pentene, cyclopentadiene, 1,4-pentadiene, 2-butyne, and piperylene,

the extractant used in the extractive distillation step is an amide compound,

the dividing wall distillation in the dividing wall distillation step is performed in a dividing wall column,

the dividing wall column distils the fraction (E) from the top of the column, drains the fraction (F) from the bottom of the column, and distils the fraction (G) from a central region of the column,

the dividing wall column has a dividing wall disposed in a longitudinal direction inside,

the dividing wall divides the inside of the dividing wall column into a feeding section on one side of the dividing wall in the direction of thickness, a removal section on the other side of the dividing wall in the direction of thickness, an upper joined column section, and a lower joined column section, and

a feeding port for feeding of the fraction containing crude isoprene is disposed in a central region between an upper region and a lower region of the feeding section.

2. The isoprene separation and recovery method according to claim 1, wherein the amide compound is dimethylformamide.

3. The isoprene separation and recovery method according to claim 1 or 2, further comprising a second extractive distillation step of performing further extractive distillation of the fraction (G) containing high-purity isoprene to obtain a fraction containing an impurity having higher solubility than isoprene in an extractant used in the extractive distillation and a fraction containing even higher purity isoprene.

4. The isoprene separation and recovery method according to claim 3, wherein the extractant used in the second extractive distillation step is an amide compound.

5. The isoprene separation and recovery method according to claim 4, wherein the amide compound used as an extractant in the second extractive distillation step is dimethylformamide.

6. The isoprene separation and recovery method according to any one of claims 1 to 5, wherein the fraction (E) containing the impurity having a lower boiling point than isoprene has an isoprene concentration of not less than 5 mass% and not more than 90 mass%.

7. The isoprene separation and recovery method according to any one of claims 1 to 6, wherein the dividing wall distillation in the dividing wall distillation step is performed in the presence of not less than 1 mass ppm and not more than 100 mass ppm of a polymerization inhibitor relative to the crude isoprene.

8. The isoprene separation and recovery method according to any one of claims 1 to 7, wherein a polymerization inhibitor is fed from a vertical direction upper part of the dividing wall column.

9. The isoprene separation and recovery method according to any one of claims 1 to 8, wherein the fraction (G) containing high-purity isoprene is a gas.

10. The isoprene separation and recovery method according to any one of claims 1 to 8, further comprising a step of removing a polymerization inhibitor from the fraction (G) containing high-purity isoprene.

11. An isoprene separation and recovery apparatus comprising:

an extractive distillation section that includes a feeding port for feeding of a mixed fluid containing isoprene and that performs extractive distillation of the mixed fluid by using an amide compound as an extractant to obtain a fraction containing an impurity having lower solubility than isoprene in an extractant used in the extractive distillation and a fraction containing crude isoprene; and

a dividing wall distillation section that includes a dividing wall column including a feeding port for feeding of the fraction containing crude isoprene and that performs dividing wall distillation of the fraction containing crude isoprene to obtain a fraction (F) containing an impurity having a higher boiling point than isoprene, a fraction (E) containing an impurity having a lower boiling point than isoprene, and a fraction (G) containing high-purity isoprene, wherein

the mixed fluid further contains at least one selected from the group consisting of pentane, pentene, cyclopentadiene, 1,4-pentadiene, 2-butyne, and piperylene,

the dividing wall column distils the fraction (E) from the top of the column, drains the fraction (F) from the bottom of the column, and distils the fraction (G) from a central region of the column,

the dividing wall column has a dividing wall disposed in a longitudinal direction inside,

the dividing wall divides the inside of the dividing wall column into a feeding section on one side of the dividing wall in the direction of thickness, a removal section on the other side of the dividing wall in the direction of thickness, an upper joined column section, and a lower joined column section, and

a feeding port for feeding of the fraction containing crude isoprene is disposed in a central region between an upper region and a lower region of the feeding section.

12. The isoprene separation and recovery apparatus according to claim 11, further comprising a second extractive distillation section that includes a feeding port

for feeding the fraction containing high-purity isoprene and that performs further extractive distillation of the fraction containing high-purity isoprene to obtain a fraction containing an impurity having higher solubility than isoprene in an extractant used in the extractive distillation and a fraction containing even higher purity isoprene.