Claims

[Claim 1]

A method for converting ethanol, comprising:

contacting a raw material mixture containing ethylene and ethanol with a catalyst in an adiabatic reactor to obtain a reaction gas containing an olefin having 3 or more carbon atoms, and

separating ethylene and propylene from the reaction gas,

wherein a molar ratio of ethylene/ethanol in the raw material mixture fed into the adiabatic reactor is 0.20 to 2.5.

[Claim 2]

The method for converting ethanol according to claim 1, wherein a molar ratio of ethylene/ethanol in the raw material mixture is 0.20 to 2.0.

[Claim 3]

The method for converting ethanol according to claim 1, wherein the raw material mixture contains an olefin having 4 to 6 carbon atoms.

[Claim 4]

The method for converting ethanol according to claim 3, wherein the total content of olefins having 4 to 6 carbon atoms in the raw material mixture is 10 to 55% by mass, based on the mass of the effective raw material fed.

[Claim 5]

The method for converting ethanol according to claim 3, wherein a molar ratio of olefin having 4 to 6 carbon atoms/ethylene in the raw material mixture is 3.0 or less.

[Claim 6]

The method for converting ethanol according to claim 1, further comprising:

separating the reaction gas into fraction A mainly containing a hydrocarbon having 1 to 3 carbon atoms and fraction B mainly containing a hydrocarbon having 4 to 8 carbon atoms; and

separating ethylene and propylene from the fraction A.

[Claim 7]

The method for converting ethanol according to claim 6, further comprising:

cooling the reaction gas to separate the reaction gas into fraction C mainly containing hydrocarbons having 6 or less carbon atoms and fraction D mainly containing water and hydrocarbon compounds having 7 or more carbon atoms.

[Claim 8]

The method for converting ethanol according to claim 6, further comprising:

recycling at least a portion of the fraction B to the reactor to use it as a portion of the raw material mixture.

[Claim 9]

The method for converting ethanol according to claim 1, wherein the reactor is a fixed-bed adiabatic reactor.

[Claim 10]

The method for converting ethanol according to claim 1, wherein a catalyst bed outlet temperature is 450°C to 590°C.

[Claim 11]

The method for converting ethanol according to claim 1, wherein a catalyst bed inlet temperature is 450°C to 590°C.

[Claim 12]

The method for converting ethanol according to claim 1, wherein a temperature difference between a catalyst bed outlet temperature and a catalyst bed inlet temperature is -80 K to 80 K.

[Claim 13]

The method for converting ethanol according to claim 1, wherein the catalyst is a zeolite-containing catalyst.

[Claim 14]

A method for producing a hydrocarbon, comprising:

a cracking step of decomposing a hydrocarbon having 2 or more carbon atoms; and

a refining step of refining a component obtained in the cracking step, wherein

in the refining step, the reaction gas obtained by the method for converting ethanol according to any one of claims 1 to 13 or a refined fraction thereof is combined with the component.

[Claim 15]

A method for producing an aromatic compound, comprising:

an aromatic compound-separating step of separating a fraction mainly containing an aromatic compound from the reaction gas obtained by the method for converting ethanol according to any one of claims 1 to 13.

[Claim 16]

An apparatus for converting ethanol, comprising:

a reactor which contacts a raw material mixture containing ethanol and ethylene with a catalyst in an adiabatic reactor to obtain a reaction gas containing an olefin having 3 or more carbon atoms; and

a first distillation column which separates the reaction gas into fraction A mainly containing a hydrocarbon having 2 to 3 carbon atoms and fraction B mainly containing a hydrocarbon having 4 to 6 carbon atoms, wherein

at least a portion of the fraction A is recycled to the reactor to be used as a portion of the raw material mixture,

wherein a molar ratio of ethylene/ethanol in the raw material mixture fed into the adiabatic reactor is 0.20 to 2.5.