CLAIMS

~~Claim~~ 1. A clean method for preparing D, L-methionine, comprising the following steps:

(1) preparing a 5-(β-methylthioethyl)glycolyurea reaction fluid by using 3-methylthio propionaldehyde, KCN and NH_4HCO_3 solutions as raw materials for continuous reaction in the tubular reactor that is gradually heated;

(2) decompressing the 5-(β-methylthioethyl)glycolyurea reaction fluid to separate NH_3~~3~~ and CO_2~~2~~ for delivery to another tubular reactor for decomposition and saponification to obtain a saponification reaction fluid;

(3) eliminating NH_3~~3~~ and CO_2~~2~~ produced during saponification through desorption of the saponification fluid to obtain a D,L-methionine potassium solution;

(4) obtaining a NH_4~~4~~HCO_3~~3~~ solution through water spray and absorption of NH_3~~3~~ and CO_2~~2~~ as separated in steps (2) and (3), and directly using use the NH_4~~4~~HCO_3~~3~~ solution as a material for preparation of the 5-(β-methylthioethyl)glycolyurea reaction fluid in step (1);

(5) cooling down the D,L-methionine potassium solution in step (3), and then using an organic solvent for reversed and continuous extraction; directly using an organic solvent recycled through distillation of an organic solvent layer for reversed and continuous extraction; raffinate produced by distillation being treated as waste fluid;

(6) delivering water that is produced through counter-current and continuous extraction in step (5) to a continuous crystallizer, simultaneously delivering CO_2 gas to the continuous crystallizer for acidification to control PH value of reaction fluid in the continuous crystallizer at ~~6~~ ~~9~~6-9, and then obtaining a crystallization intermixture;

(7) separating solid and liquid in the crystallization intermixture to obtain crude D,L-methionine product and a crystallization mother solution; washing crude D,L-methionine product with water for solid-liquid separation to obtain a filter cake of D,L-methionine and washing filtrate;

(8) drying the filter cake of D,L-methionine under the protection of inert gas to obtain D,L-methionine product;

(9) combining the crystallization mother solution and the washing filtrate from step (7) for delivery to a decomposition column to fully decompose $KHCO_3$ into K_2CO_3 for release of CO_2 gas; released CO_2 gas that is subjected to compression is delivered to continuous crystallizer for

acidification and crystallization;

(10) using the K_2CO_3 containing mother solution as obtained in step (9) for absorption of HCN gas to prepare a KCN solution that is the material for preparation of 5-(β-methylthioethyl)glycolyurea in step (1).

~~Claim~~ 2. The clean method for preparing D,L-methionine according to Claim 1, characterized in that, in the step (1), a mole ratio of 3-methylthio propionaldehyde, KCN and NH_4HCO_3 is ~~1:1-1.1:2~~ 1:1-1.1:2-3;

~~Claim~~ 3. The clean method for preparing D,L-methionine according to Claim 1, characterized in that, in the step (1), a gradual heating range is ~~50~~ 50-150°C with reaction time up to ~~3~~ 3-15 minutes.

~~Claim~~ 4. The clean method for preparing D,L-methionine according to Claim 1, characterized in that, in the step (2), the temperature for decomposition and saponification is ~~140~~ 140-220°C with time up to 2-15 minutes.

~~Claim~~ 5. The clean method for preparing D,L-methionine according to Claim 1, characterized in that, in the step (5), the temperature of the D, L-methionine potassium solution is reduced to ~~0~~ 0-40°C before using the organic solvent equivalent to ~~0.5~~ 0.5-2 times the weight of the D, L-methionine potassium solution for reversed and continuous extraction.

~~Claim 6~~. The clean method for preparing D,L-methionine according to Claim 1 ~~or Claim 5~~, characterized in that, in the step (5), the organic solvent for reversed and continuous extraction includes one or more of toluene, ethylbenzene, dimethylbenzene, n-butyl alcohol, isobutanol, n-pentanol, 2-methyl-1-butanol, isoamylol, sec.-amyl alcohol, 3-pentanol, tert-amyl alcohol, n-hexyl alcohol, 4-methyl-2-pentanol, 2-ethyl alcohol, 2-methyl amyl alcohol, heptanol, 2-heptanol, 3-heptanol, 2-ethylhexyl alcohol, 2-octanol, octanol, 3,5,5-trimethylhexanol, ether, methyl tertiary-butyl ether, isopropyl ether, n-propyl ether, n-butyl ether, isoamyl ether, hexyl ether, 2-methyl tetrahydrofuran, anisole, ethoxybenzene, 3-methylanisole, ethyl benzyl ether, ethylene glycol diethyl ether, diethylene dipropyl ether and ethylene glycol di-butyl ether.

~~Claim~~ 7. The clean method for preparing D,L-methionine according to Claim 1, characterized in that, in the step (6), the temperature for continuous crystallization is ~~0~~ 0-40°C, whereas the reaction fluid stays inside the continuous crystallizer for 0.5-5 hours.

~~Claim~~ 8. The clean method for preparing D,L-methionine according to Claim 1, characterized in that, in the step (9), the temperature and pressure of decomposition column are ~~110~~ 110-160°C and ~~0.15~~ 0.15-0.8MPa with decomposition reaction time up to ~~1~~ 1-4 hours.

9. The clean method for preparing D,L-methionine according to Claim 5, characterized in that, in the step (5), the organic solvent for reversed and continuous extraction includes one or more of toluene, ethylbenzene, dimethylbenzene, n-butyl alcohol, isobutanol, n-pentanol, 2-methyl-1-butanol, isoamylol, sec.-amyl alcohol, 3-pentanol, tert-amyl alcohol, n-hexyl alcohol, 4-methyl-2-pentanol, 2-ethyl alcohol, 2-methyl amyl alcohol, heptanol, 2-heptanol, 3-heptanol, 2-ethylhexyl alcohol, 2-octanol, octanol, 3,5,5-trimethylhexanol, ether, methyl tertiary-butyl ether, isopropyl ether, n-propyl ether, n-butyl ether, isoamyl ether, hexyl ether, 2-methyl tetrahydrofuran, anisole, ethoxybenzene, 3-methylanisole, ethyl benzyl ether, ethylene glycol diethyl ether, diethylene dipropyl ether and ethylene glycol di-butyl ether.