Title: PROCESS FOR PRODUCTION OF SODIUM CYANIDE

Abstract: A process for the production of sodium cyanide with urea and sodium carbonate as main raw materials comprises: a) step for blending raw materials; b) step for first-order reaction; c) step for second-order reaction; d) step for centrifugal atomization; e) step for agitating and dissolving; f) step for precipitating and filtering; g) step for vacuum distillation; and h) step for centrifugal separating and drying. High purity (above 98%) of sodium cyanide finished product may be obtained.
PROCESS FOR PRODUCTION OF SODIUM CYANIDE

Field of the invention
The present invention relates to a process for producing high purity (above 98%) of sodium cyanide with urea and sodium carbonate.

Background of the invention
There have been several methods for production of sodium cyanide including the method to refine HCN gas, that is, intermediate product of petroleum processing industry and chemical industry and absorb it into NaOH solution, the method to make metal sodium, bituminous coal and liquid ammonia react, and a method by methanol oxidation etc.
The purity of sodium cyanide produced by the above methods is 80% ~ 98%.
The defect of the above production methods is that there exist the environmental pollution by toxic gas, that is, HCN, high production cost and explosion danger and difficulty in obtaining higher purity than 98 %.

Objects of the invention
The object of the present invention is to provide a process for producing high purity (above 98 %) of sodium cyanide using urea and sodium carbonate as main raw materials.

Summary of the Invention
The present invention discloses a process for production of high purity (above 98%) of sodium cyanide using urea and sodium carbonate.

Brief Description of Drawings
Figure 1 shows the process diagram for production of sodium cyanide according to the present invention.
**Detailed description of the Invention**

The invention discloses a process for the production of sodium cyanide with urea and sodium carbonate as main raw materials comprising following steps.

**a) Step for mixing of raw materials**
2.5~2.8:1 mol ratio of urea and sodium carbonate are charged a mixer with, and 200 mesh-sized iron powder and 200 mesh-sized anthracite coal powder mixed by 1:1 weight ratio are added by the quantity corresponding to 0.2~0.4 wt% of raw material, and then raw materials and additives are uniformly mixed.

**b) Step for first-order reaction**
The mixture of urea, sodium carbonate and additives that passed the step for blending of raw materials is charged a reactor with and then the temperature of the reactor inside is held at 300~350°C for 2 hours to make reactants of the mixture react.

**c) Step for second-order reaction**
After the first-order reaction, the temperature of the reactor inside is held at 650~750°C for 1 hour to make the first-order reaction product deoxidized.

**d) Step for centrifugal atomization**
After second-order reaction, the product in melting state is dispersed and atomized by centrifugal force by a rotating-cylinder of which diameter is 600~800 mm and rotation speed is 400~600 rpm, and by rapid -cooling Content of sodium cyanide in the obtained product is 62~68%.

**e) Step for agitation and dissolution**
The atomized reaction-product is charged a dissolution tank with and a mixed solvent corresponding to 4 times the reaction product volume is added and then a mixture is obtained by agitating the atomized reaction product and the mixed solvent at 300 rpm for 20~30 min.
The mixed solvent consists of 5~20 %, preferably 8~15% of benzene aromatic compound, 30~45% preferably 35~42% of methanol (or ethanol) and water.
During the step for agitation and dissolution, sodium cyanide is fully dissolved into mixed solvent and un-reacted reactants including sodium carbonate remain as sediment.

**f) Step for precipitation and filtration**

Sodium carbonate sediment is separated from the mixture(solution and sediment) which has passed through the step for agitation and dissolution by 200 mesh-sieve passage, while the pressure of system inside is 13.3~40 KPa.

The separated sediment, namely, un-reacted sodium carbonate is recycled into the step for blending of raw material through the step for vacuum-drying.

The sodium cyanide solution which has passed the sieve is transferred into the step for vacuum-distillation by vacuum of the system inside.

**g) Step for vacuum distillation**

Step for vacuum distillation consists of filtering by a buffered filtration tank and distillation by a distiller, and the buffered filtration tank has 200 mesh sieve, so that sodium cyanide solution which has passed through the step for precipitation and filtration can be transferred into the distiller.

The distiller consists of a double-wall tank of which the inside has many coil pipes at some spaces with outside blades for heat exchange so as to increase evaporation speed.

Solution of sodium cyanide which has passed through the tank for buffered-filtration flows between the inside wall of double wall-tank and the outsides of coil pipes with blades for heat exchange while 80°C~85°C of hot water flows between double walls of tank and through the insides of the coil pipes, so that mixed solvent can be distilled.

During distillation, the mixed solvent is evaporated and then condensed at a 10~15°C condenser and is recycled.

After some quantity of sodium cyanide piles up on the ground of distiller, it is discharged, being rapid-cooled under 35°C.

By this step, solid sodium cyanide is obtained and is fed into a step for centrifugal separation.
h) Step for centrifugal separation and drying

After the mixed solvent is recovered at the step for vacuum distillation, leftover solid state of sodium cyanide becomes crystal hydrate of NaCN·2H₂O by removing residual solvent and moisture through centrifugal separator.

Crystal hydrate of sodium cyanide is shipped in the packed form of product on use for cyanation.

Sodium cyanide for use in the form of plating liquid is packed in anhydrate state through first vacuum drying, moulding, and second drying.

The purities of both crystal hydrate and anhydrate of sodium cyanide produced by the above method are above 98 %.
Claims

1. A process for the production of sodium cyanide with urea and sodium carbonate as raw materials, comprising:
   a) step for mixing of raw materials
   b) step for first-order reaction
   c) step for second-order reaction
   d) step for centrifugal atomization
   e) step for agitation and dissolution
   f) step for precipitating and filtering
   g) step for vacuum distillation
   h) step for centrifugal separating and drying

2. The process of Claim 1 wherein a) step for mixing of raw materials is characterized in that 2.5~2.8:1 mol ratio of urea and sodium carbonate are charged the blender, and 200 mesh-sized iron powder and 200 mesh-sized anthracite coal powder mixed by 1:1 weight ratio are added by the quantity corresponding to 0.2~0.4 % of raw material, and then raw materials and additives are uniformly mixed.

3. The process of Claim 1 wherein b) step for first-order reaction is characterized in that the mixture of claim 2 is charged a reactor with and then the temperature of the reactor inside is hold at 300~350°C for 2 hours to make the reactants of the mixture react.

4. The process of Claim 1 wherein c) step for second-order reaction is characterized in that the temperature of the reactor inside is hold at 650~750°C for 1 hour to make the first-order reaction product deoxidized.

5. The process of Claim 1 wherein d) step for centrifugal atomization is characterized in that second-order reaction product in melting state is dispersed and atomized by centrifugal force by a rotating-cylinder and by rapid-cooling.

6. The process of Claim 1 wherein e) step for agitation and dissolution is characterized in that the atomized reaction-product is charged a dissolution tank with, a mixed solvent corresponding to 4 times the reaction product volume is added and then a mixture is obtained by agitating the atomized reaction product and the mixed solvent for 20~30 min.
7. The step of Claim 6 wherein the mixed solvent is characterized in that it consists of 5~20 %, preferably 8~15% of benzene aromatic compound, 30~45% preferably 35~42% of methanol (or ethanol) and water

8. The process of Claim 1 wherein f) step is characterized in that sodium carbonate sediment is separated from the mixture of claim 6 by 200 mesh-sieve passage, and is sent to step for mixing of raw materials while the pressure of system inside is 13.3~40 KPa

9. The process of Claim 1 wherein g) step is characterized in that the solution product of f) step of claim 8 is re-filtered by 200 mesh-sieve in a tank for buffing-filtering, and then distilled by passing between the inside wall of a double-wall tank and the outsides of coil pipes with blades for heat exchange while 80°C~85°C of hot water flows between double walls of tank and through the insides of the coil pipes.
Figure 1

- Weighing raw materials
- Mixing
- Additive 1
- Ammonium carbonate
- 1st-order reaction
- Additive 2
- 2nd-order reaction
- Centrifugal atomization
- Rapid-cooling
- Agitating & dissolving
- Mixed solvent
- Vacuum drying
- Deposit
- Precipitating
- Filtering
- Condensation
- Heating
- Vacuum distillation
- Discharging
- Rapid-cooling
- Centrifugal separating
- Vacuum drying
- Forming
- Drying
- Package
- Hydrate
- Package
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
C01C 3/10(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C01C 3/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
CNKI, CPRS, WPI, ISI WEB OF KNOWLEDGE: sodium carbonate, Na2CO3, urea, carbamide, sodium cyanate, sodium cyanide, NaCNO, NaOCN, NaCN, anthracite coal, docoxidized

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>Y</td>
<td>JP S4929837 B (TOHOKU HIRYO KK) 07 August 1974 (1974-08-07) claim 1</td>
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[✔] Further documents are listed in the continuation of Box C.  [✔] See patent family annex.

* Special categories of cited documents:
  "A" - document defining the general state of the art which is not considered to be of particular relevance
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  "&" - document member of the same patent family

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Form PCT/ISA/210 (second sheet) (July 2009)
### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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| Y        | Chinese People's Liberation Army 3604th Factory. "Relationship of epsilon phase and process"  
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