Amino Acids

What is amino acid?

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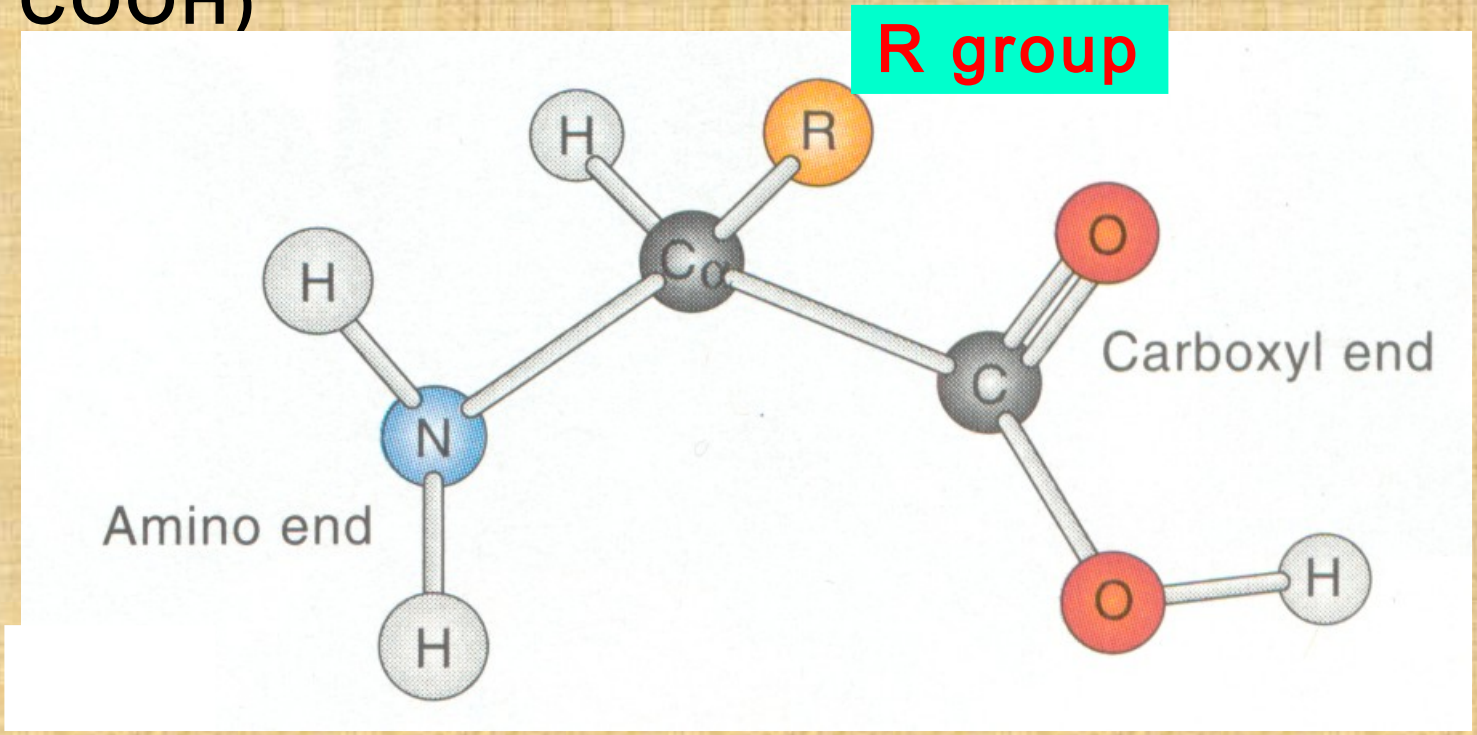
- Amino Acid: aminated carboxylic acid (R-COOH)



Classification of Amino Acid

1. By the location of Amino-group : □ /β / γ-AA
2. By its acidity : neutral/ acidic/ basic AA
   ratio of Amino-group to carboxylic group
3. By whether containing phenyl group
   aromatic / non aromatic AA
4. By its occurrence in protein
   Protein / non protein AA
5. By polarity of R group :
   polar / apolar side chain AA
6. By its nutrient value to human:
   Essential AA and non-essential AA

PROTEIN ANALYSIS

What is Protein ?

- **polymer of 20 α- amino acids, with mol.wt from 5000 to1000,000 daltons.**
- **N is most distinguished element: among the composing elements of C,H, N, O, S, for some proteins: P, Cu, Fe, I.**
- **N content in different proteins ranging from 13.4% -19.1%, and averagely 16%.**
- **Most abundant component in cells: 50% of dry cells by weight**

Protein content in food in %

Cereals :	(%)
Brown Rice	7.9
Polished rice	7.1
Wheat flour, whole-grain	13.7
Corn flour, whole-grain	6.9
Corn starch	0.3

Protein content in food

legumes ：

Soybean, raw	36.5
Beans, kidney, raw	23.6
Tofu, raw, regular	8.1

Protein content in food

Fruits & vegetables :

Apple, raw, with skin	0.2
Strawberry, raw	0.6
lettuce , raw	1.0

Protein content in food

Dairy products :

Milk, whole, fluid	3.3
Milk, skim, dry	36.2
Cheese, cheddar	24.9
Yogurt	5.3

Protein content in food

Meat, poultry, fish:

Beef	18.5
Dry beef	29.1
Chicken, breast meat, raw	23.1
Ham	17.6
Egg, raw, whole	12.5
Finfish, raw,	17.9

Conversion factors for Foods

N to Protein conversion factors

Foods	factors
Egg or meat	6.25
Dairy products	6.38
Wheat	5.70
Other cereal grains and oilseeds	6.25
Almonds	5.18
Peanuts	5.46
Other tree nuts and coconut	5.30

Kjeldahl's method

Principles:

1. **Digest the organic compounds with strong sulfuric acid in the presence of catalysts while heating.**
2. **The total organic N is converted to ammonium sulphate.**
3. **Neutralize the digested sol'n with abundant alkali. Here, the N is converted to ammonium hydroxide, and then being distilled into a boric acid solution and converted to ammonium borate.**
4. **Titrate ammonium borate with strong acid.**

   (please notice that N: HCl = 1:1)
5. **N content in proteins is averagely 16%.**

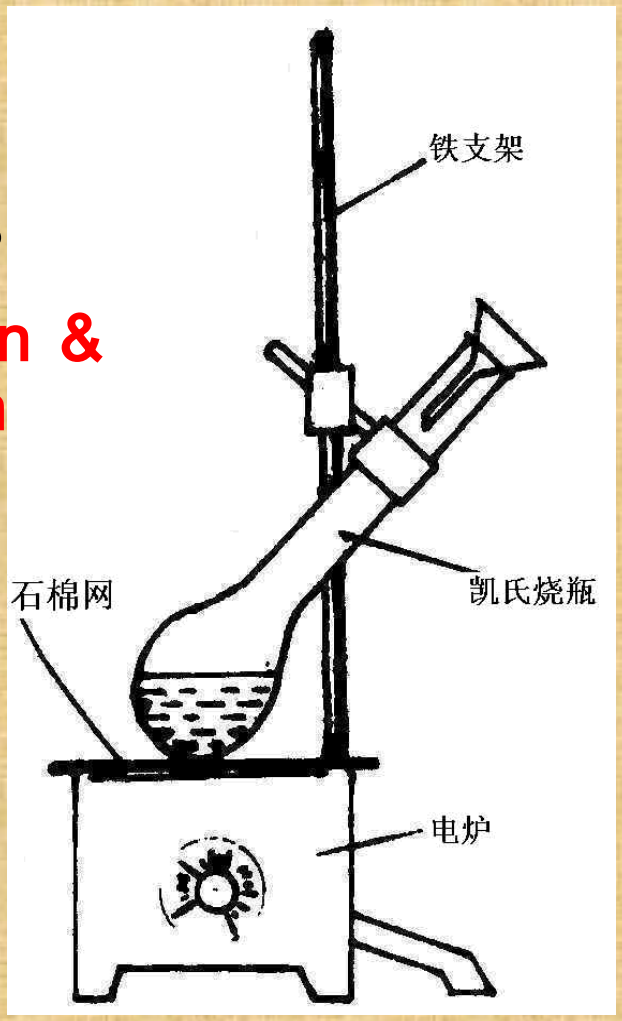
Equipments

- -a. Kjeldahl digestion flask - 500 or 800 ml
- b. Kjeldahl distillation apparatus,
- c. Conical flask, 250 ml
- d. Burette 50 ml.

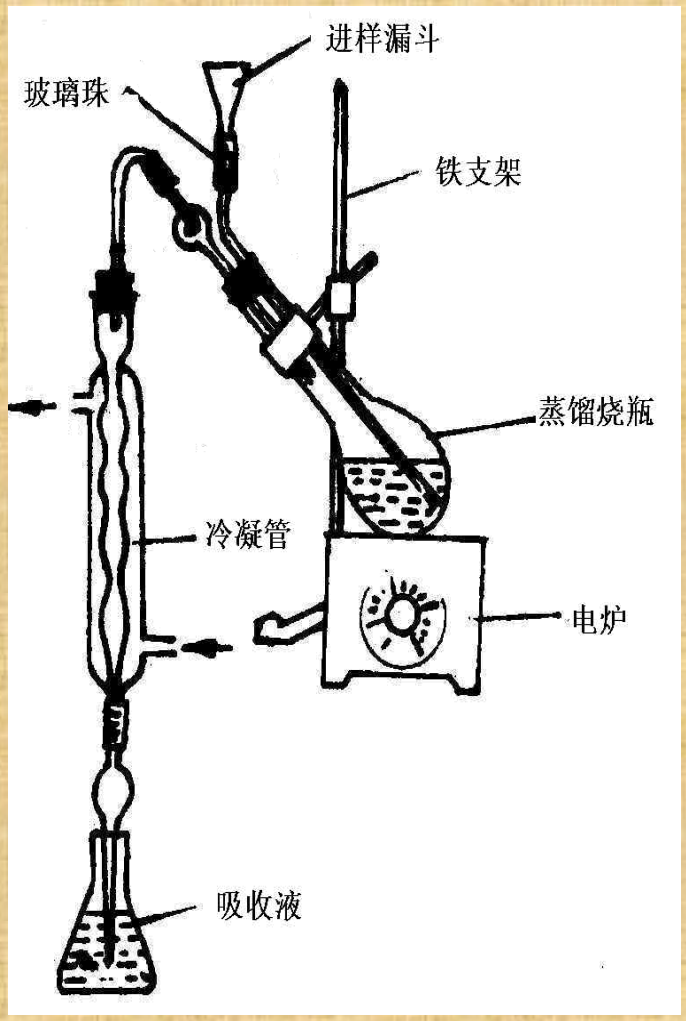
Apparatus used in Kjeldahl

I. Digestion apparatus

II. Distillation & absorption apparatus



(I)



(II)

Procedure

- Add 2gm of sample+0.7gm mercuric oxide+15gm potasium sulfate
- Add zinc granules
- Heat mixture gently for 90mnts until the froathing ceaces
- Then boiled directly and continued digestion
- Cool the contents

Procedure

- Add 150ml of water to the cooled digestion
- Transfer the content to R.B flask
- Connect to kjeldhal assembly
- Add 40% NaOH solution carefully through the sides
- Add zinc granules
- Distill all ammonia to boric acid
- Titrate with 0.1N NaOH solution (indicator-methyl red+methylene blue)

Calculations

- % Nitrogen (as is) =

  (ml 0.1N H_2SO_4 - Blank - ml0.1N NaOH) × 0.0014 × 100 ,, the whole divided with sample wt.

% Protein = % Nitrogen × 6.25

Points that need your close attention

1. Amount of protein sample and reagents used should be proportional.

2. All the working solution should be prepared with ammonia-free distilled water

3. Mildly heating When digestion, so that no sample to spatter onto flask wall.

4. Rotate the flask while digestion.

5. Add antifoam (silica oil) if necessary.

Points that need your close attention

6. Connect well the distillation apparatus before adding alkali into digested solution.

7. Cold water bath is a good choice to lower the temp.

8. Using indicating paper to help for the determination of distillation terminus.

9. Indicators of methylene blue and methyl red are added to absorption bottle before carrying in the distillation

THANKS