Lecture 3. Raw materials in the chemical industry. Types and stocks of raw materials. Minerals concentration.

Raw materials are natural materials used in industrial production.

Raw material is a basic element of production, from which the economic production, choice of technology and equipment and the quality of the product heavily depend.

Classification of chemical raw materials

- On the state of aggregation: solid, liquid, gaseous;
- On the chemical state: inorganic, organic;
- in origin: mineral, vegetable and animal, air, water

Requirements for chemical raw materials

- little staging of the production process;
- physical state of the system, requiring minimal energy cost to create optimal process conditions;
- scattering minimum energy input;
- minimum energy loss products;
- It may be lower process parameters (temperature, pressure) and energy consumption for changing the state of aggregation reagents and implementation of chemical processes;
- the maximum content of the desired product in the reaction mixture.

Problems using raw materials

- High share in the cost of raw materials of chemical products,
- Rapid depletion of raw materials (world mineral production for the first half of the XX century has grown by 3.4 times),
- Appreciation of its production processes (in recent years, oil production costs increased 2-fold, 1.5-fold in the coal, natural gas, 2.5 times).

Destinations of rational use of raw materials

- use of cheaper raw materials (local, with minimal production);
- use of secondary material resources (production and consumption waste byproducts from other industries);
- use of a less concentrated feed (poor ores);
- complex processing of raw materials (maximum degree of utilization of raw materials);
- recycling of raw materials.

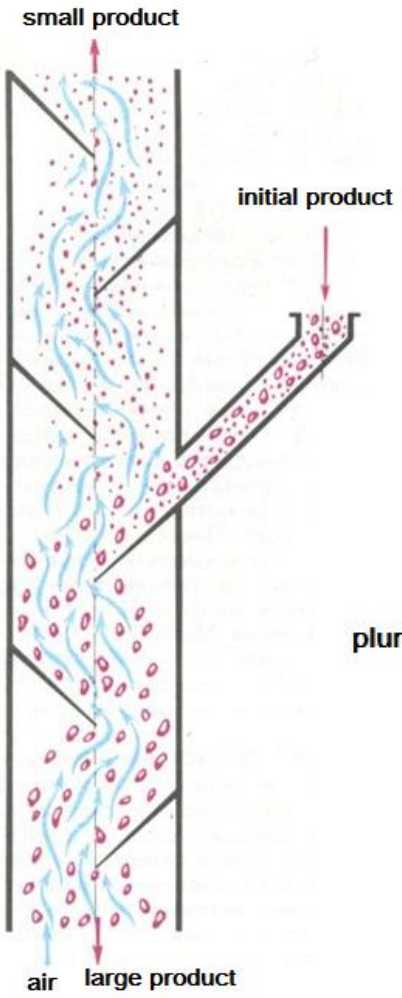
Complex use of raw materials allows

- to minimize the loss of raw material processing,
- full use of waste products,
- to expand the resource base,
- to increase the volume of production,
- lower costs of raw materials and energy,
- to reduce environmental pollution by industrial emissions,
- to reduce capital investment in production,
- to reduce production costs,
- to improvement of all technical and economic indicators of production.

Preparation of chemical raw materials for processing

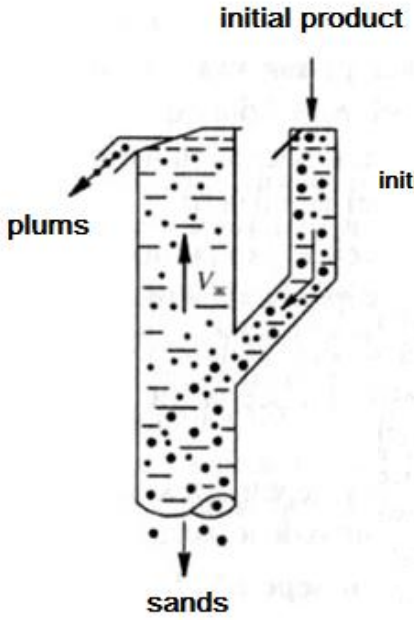
- In the process of preparing raw acquires a predetermined concentration of the useful component, moisture determined by the conditions of processing the content of impurities, the desired dispersion.
- Operations of training materials are varied and depend on the state of aggregation.
- The complex of operations to prepare the most common in the chemical industry of solid materials includes: classification, grinding (or in certain cases, enlargement), dehydration, and enrichment.

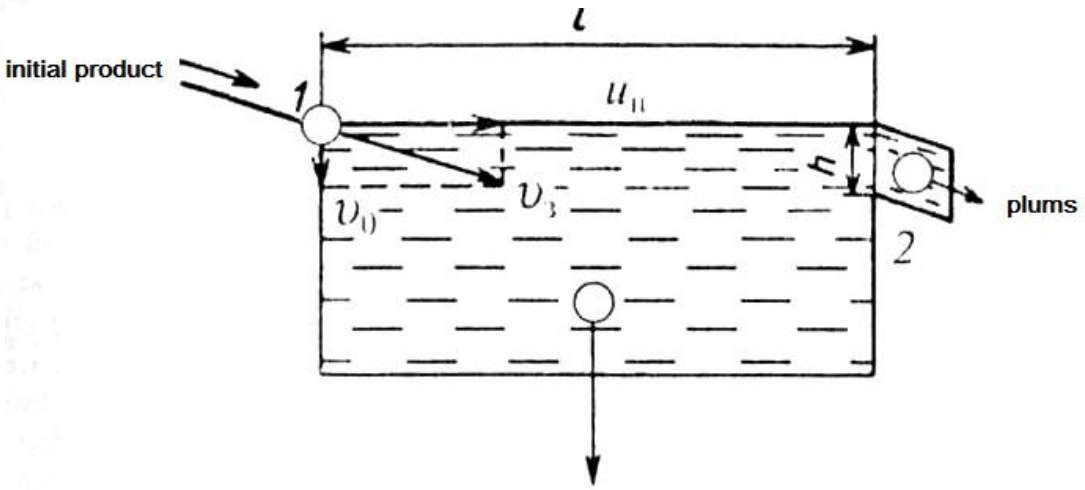
Classification is the process of separation of homogeneous bulk materials into fractions (classes) size of their constituent particles.



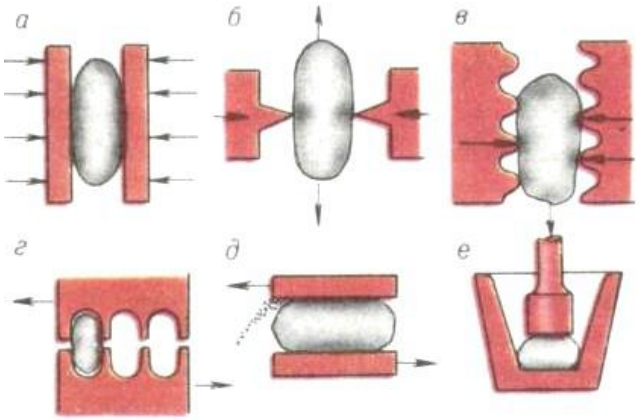
Separation of a mixture of particle deposition velocity in the air with separators (air classification

Separation of a mixture of particles by their sedimentation velocity in a liquid phase (hydraulic classification)

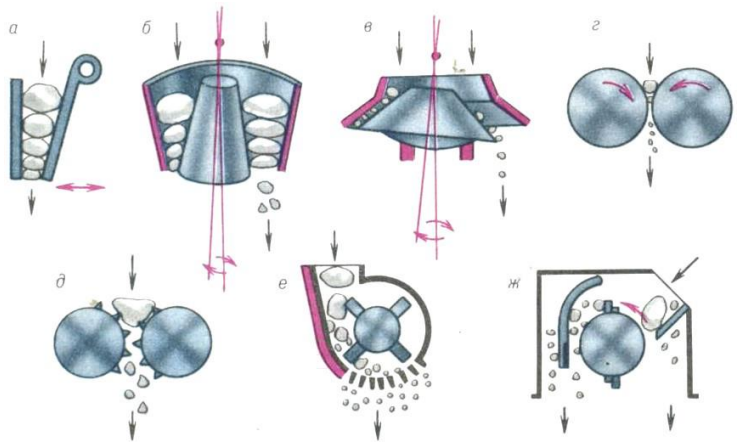




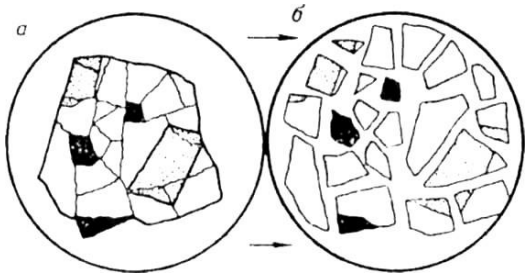
Grinding is the mechanical process of fission of solid body into parts by the application of external forces. Grinding can be done by methods of impact (I), crushing (II), and abrasion (III).



Methods crushing solids



Schematic diagrams of crushers



Scheme to destruction the solid state by grinding:
a - before grinding, b - after crushing

Dehydration of material is achieved by runoff, sedimentation (in the case of liquid systems) and drying.

Drying is a process of removing of moisture or other fluid from the solids by evaporation and removal of the formed pair.

The drying process is carried out in dryer of various designs at atmospheric pressure or in vacuum.

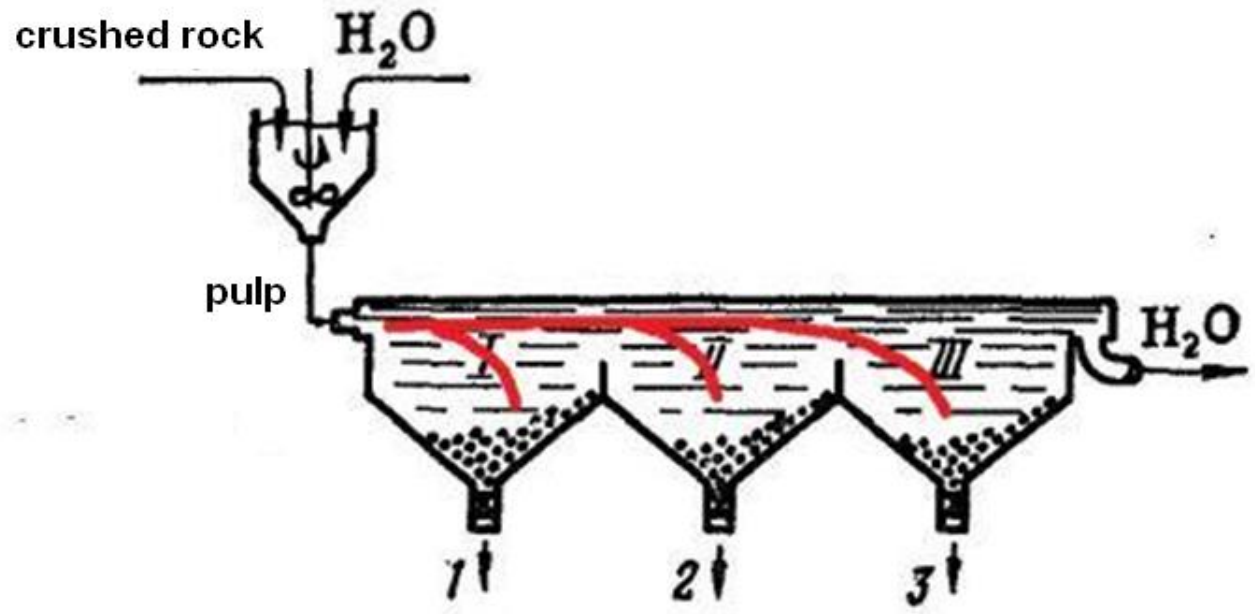
Enrichment is the process of separating the useful part of the raw material (useful component) from the gangue (ballast) in order to increase the concentration of the useful component.

There are *mechanical, chemical and physical and chemical methods*.

Mechanical methods of enrichment:

- Gravity;
- Electromagnetic;
- Electrostatic.

Gravity enrichment based on the settling velocity of different particles of different size and density in a gas or liquid stream, or in the centrifugal force.

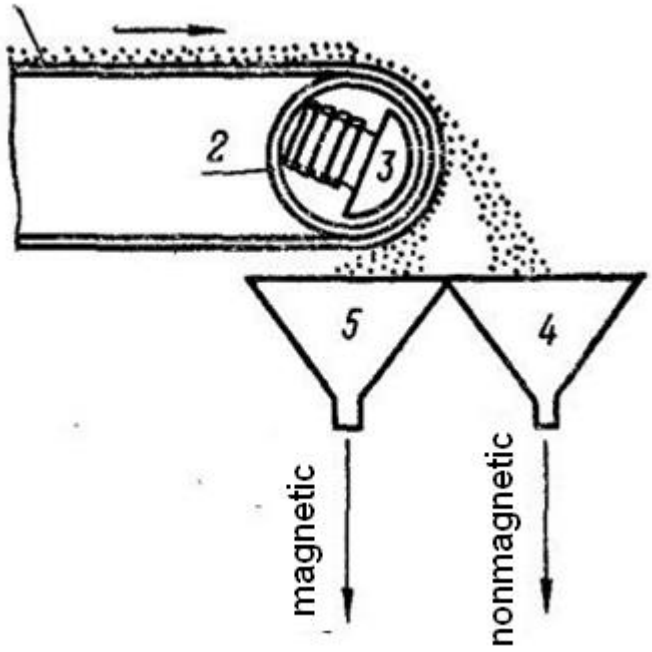


Scheme of wet gravity separation:

I-, II-, III-settling coffer.

1-the heavy fractions, 2-the middle fraction, 3- the fine fraction

Electromagnetic based on different components of the magnetic permeability material

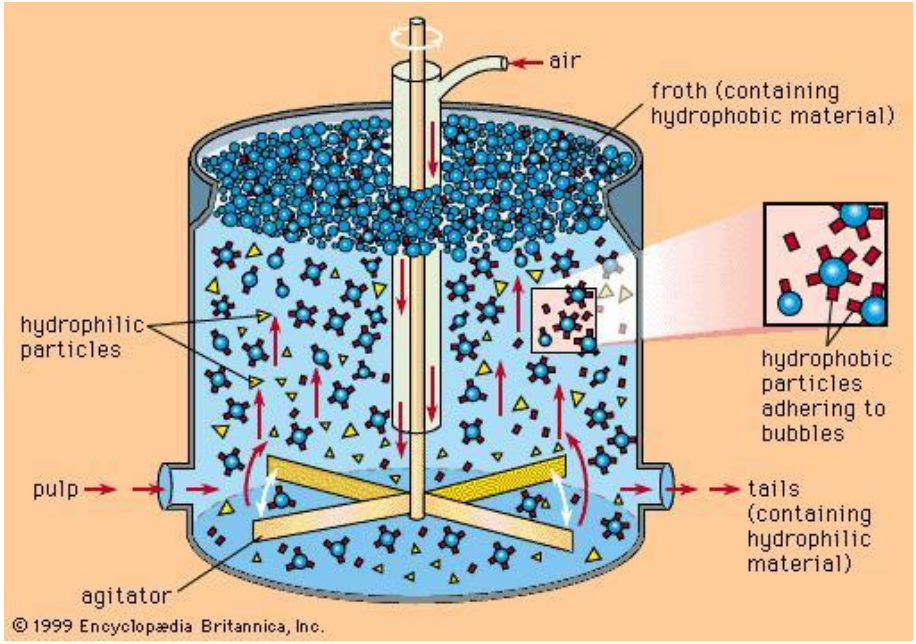


Electrostatic based on different components of the electrical conductivity of materials.

Electromagnetic separator scheme:
1 - the conveyor belt;
2 - drum conveyor;
3 - electromagnet;
4, 5 - hoppers

Physical and chemical methods of enrichment

Flotation (from floatation - floating) is a method of enrichment of solid materials, based on the difference in wettability of its components.



Flotation machine with air agitation