

**Stability and coagulation of colloidal solutions. Classes of disperse systems:
powders, suspensions, pastes, emulsions, aerosols.**

Stability of disperse systems is characterized by their parameters that are constant in time – degree of dispersion and uniform distribution of particles of dispersed phase in continuous phase.

Stability of disperse systems is divided in to two types:

1. **Sedimentation stability;**
2. **Aggregate stability.**

Coagulation – aggregate stability violation of disperse system, leading to adhesion of particles. Coagulation looks like opacity, change of color and forming precipitate.

The main reasons leading to coagulation of colloidal solutions:

1. Change of temperature.
2. Mixing or vibration.
3. Change of concentration.
4. Adding electrolytes.

The minimal concentration of electrolyte, causing coagulation of colloidal solution is called the coagulation threshold:

$$\gamma = \frac{C_{el} V_{el}}{V_{sol} + V_{el}},$$

where C_{el} and V_{el} – concentration and volume of electrolyte, V_{sol} – volume of colloidal solution.

Coagulation ability P – value inverse to the coagulation threshold:

$$P = \frac{1}{\gamma}.$$

Shulze-Hardi rule:

Coagulation causes ion, which charge sign is opposite to the charge sign of colloidal particles.

Coagulation ability of the ion increases with increase of its charge value.

Classes of disperse systems.

Suspensions – coarse dispersion system with solid dispersed phase and liquid continuous phase (S/L). Suspensions are divided into coarse (diameter of particles more than 100 μm or 10^{-4} m), finely dispersed (from 100 to 0,5 μm or $10^{-4} \div 0,5 \times 10^{-6}$ m) and slimes (from 0,5 μm to 100 nm or $0,5 \times 10^{-6} \div 10^{-7}$ m).

Suspensions are commonly sedimentation unstable.

Pasts – highly concentrated suspensions, in which volume concentration of particles is comparable or higher than for continuous phase.

Emulsions – dispersion systems with liquid dispersed phase and liquid continuous phase (L/L).

Examples of emulsions are milk, plant oils, cheese.

Two types of emulsions are known: – **direct**, with drops of nonpolar liquid in polar liquid, and **reverse**, with drops of polar liquid in nonpolar liquid. The most commonly founded are emulsions in which one of phases is water. Наибольшее распространение имеют эмульсии, в которых одна из фаз – вода. That's why direct emulsions are called “oil in water” (O/W), and reverse emulsions are called “water in oil” (W/O).

Emulsifiers – substances used for emulsion stabilization.

- 1) Surface active substances.
- 2) Higher molecular substances.
- 3) Finely dispersed powders.

Bankroft rule:

When emulsifying, the continuous phase appears to be that phase in which emulsifier is better soluble.

Foams – cellular dispersed systems, formed by gas or vapor bubbles congestion, divided by thin layers of liquid (gas in liquid – G/L).

Aerosols – dispersed systems, consisting of small particles, suspended in air or other gas.

Powders - materials, consisting of multiple individual solid particles, size of which does not exceed several hundreds of micrometers. Like smokes and dusts, powders are systems of type “solid in gas” (S/G).