

Classification of dispersions

Dispersion (dispersed system) is a mixture of two substances, one of which (dispersed phase) is distributed in form of subdivided particles throughout another substance (continuous phase, dispersion medium).

- **Molecular dispersions**

Molecular dispersion is a true solution of a solute phase in a solvent. The dispersed phase (solute) is in form of separate molecules homogeneously distributed throughout the dispersion medium (solvent). The molecule size is less than 1 nm (4×10^{-8} inch). The examples of molecular dispersions: air (a molecular mixture of Oxygen, Nitrogen and some other gases), electrolytes (aqueous solutions of salts), metal alloys Solid solutions.

- **Colloids**

Colloids are micro-heterogeneous dispersed systems, in which the size of the dispersed phase particles is within the range 1 - 1000 nm (4×10^{-8} - 4×10^{-5} inch). The colloids phases can not be separated under gravity, centrifugal or other forces. Dispersed phase of colloids may be separated from the dispersion medium by micro-filtration. The examples of colloids: milk (emulsion of fat and some other substances in water), fog (aerosol of water micro-droplets in air), opal (colloidal silica), Silica aerogel monolith, Alumina aerogel monolith.

- **Coarse dispersions (suspensions)**

Coarse dispersions are heterogeneous dispersed systems, in which the dispersed phase particles are larger than 1000 nm (4×10^{-5} inch). Coarse dispersions are characterized by relatively fast sedimentation of the dispersed phase caused by gravity or other forces. Dispersed phase of coarse dispersions may be easily separated from the continuous phase by filtration.

In addition to the classification by particle size, dispersions can also be labeled by the combination of the dispersed phase and the medium phase that the particles are suspended in. Aerosols are liquids dispersed in a gas, sols are solids in liquids, emulsions are liquids dispersed in liquids (more specifically a dispersion of two immiscible liquids), and gels are liquids dispersed in solids.

Components phases		Homogeneous mixture	Heterogeneous mixture	
Dispersed material	Continuous medium	Solution: Rayleigh scattering effect on visible light	Colloid (smaller particles): Tyndall effect on visible light near the surface	Suspension (larger particles): no significant effect on visible light
Gas	Gas	Gas mixture: air (oxygen and other gases in nitrogen)		

Liquid			Aerosol: fog, mist, vapor, hair sprays, moisted air	Aerosol: rain (also produces rainbows by refraction on water droplets)
Solid			Solid aerosol: smoke, cloud, air particulates	Solid aerosol: dust, sand storm, ice fog, pyroclastic flow
Gas		Oxygen in water	Foam: whipped cream, shaving cream	Bubbling foam, boiling water, sodas and sparkling beverages
Liquid	Liquid	Alcoholic beverages (cocktails), sirups	Emulsion: miniemulsion, micro emulsion, milk, mayonnaise, hand cream, hydrated soap	unstable emulsion of a soap bubble (at ambient temperature, with iridescent effect on light caused by evaporation of water; the suspension of liquids is still maintained by surfacic tension with the gas inside and outside the bubble and surfactants effects decreasing with evaporation; finally the bubble will pop when there's no more emulsion and the shearing effect of micelles will outweigh the surface tension lost by evaporation of water out of them)

Solid		Sugar in water	Sol: pigmented ink, blood	Mud (soil, clay or silt particles suspended in water, lahar, quicksand), wet plaster/cement/concrete, chalk powder suspended in water, lava flow (mix of melted and solid rock), melting ice creams
Gas	Solid	Hydrogen in metals	Solid foam: aerogel, styrofoam, pumice	
Liquid		Amalgam (mercury in gold), hexane in paraffin wax	Gel: agar, gelatin, silicagel, opal ; frozen ice creams	
Solid		Alloys, plasticizers in plastics	Solid sol: cranberry glass	natural rocks, dried plaster/cement/concrete, frozen soap bubble