

Understanding differences between solutions, emulsions, colloids and dispersions

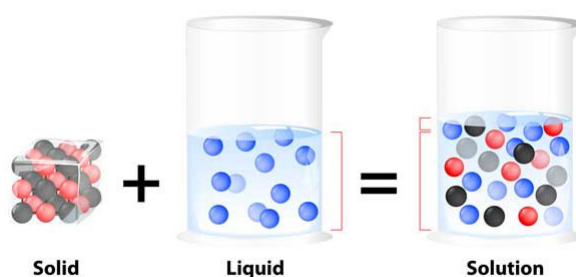


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Analysis of samples in laboratories more than often requires pre-treatment steps for extraction, isolation, concentration or dilution to measurable concentration ranges.

This is generally achieved by dissolving the sample in a suitable solvent. However, the solubility of a compound in a solvent depends on the affinity between the compound and the solvent.



Homogeneous solution of a solid in liquid

Depending on the degree of affinity the resulting mixtures are classified as solutions, suspensions, emulsions or colloids. The differences between these terms are often not clear to students and researchers, and they end up using them interchangeably.

This leads to some serious confusion and complications. So the objective of the article is to offer some clarity on these terms in such a way that you will be able to use them appropriately everywhere.

Let's now get into the details and find the difference between emulsion and suspension and solutions and colloids.

Solution

A solution results when there is complete miscibility between the solute and the solvent at a temperature. The solubility of a solute is temperature dependent and increases with increasing temperature. At a given temperature if excess solute is added to a solvent then the excess amount



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temperature. At a given temperature if excess solute is added to a solvent then the excess amount fails to dissolve and settles down even after mechanical homogenization.

A solution is a clear homogeneous mixture and the solute particles are no longer visible nor do they settle down. The particles of solute are of molecular size dimensions and do not scatter a light beam passing through it.

As the composition is homogeneous it is not possible to separate the solute from the solvent by filtration. The only option available is to resort to distillation which removes the solvent and leaves behind a solid residue of the solute.

Suspensions

Most people are confused about what suspension solution is. Suspensions are obtained when insoluble solid particles are dispersed in a liquid medium. On shaking the solute particles can be evenly dispersed in the medium but if left undisturbed the solute particles which range from 0.5 to 5 μm tend to settle down and can be separated from the solution by filtration or centrifugation.

Colloids

A colloid results when particles ranging between 1 and 1000 nanometers in diameter are dispersed in the liquid solvent. A colloid is a homogeneous mixture and the solute does not settle out on standing. Colloids can be distinguished from solutions as they exhibit light scattering. Milk is an example of a colloid solution which consists of fat particles evenly distributed in water.

Emulsions

An emulsion like a colloid comprises of a dispersion of two or more immiscible liquids. Oil and water are immiscible and form emulsions when mixed and shaken. Minute oil droplets evenly disperse throughout the water.

Due to the phenomenon of distortion of light emulsions generally appear cloudy. Dilute emulsions often appear bluish due to greater scatter of lower wavelengths of light. It is possible to disperse any of the liquids in the other such as oil and water or water in oil.

The minor component does not separate from the major component even if left to stand undisturbed indefinitely. Some emulsions tend to form a film over another phase in the solution to form globules that repel one another allowing them to remain suspended or dispersed indefinitely.

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The terms colloid and emulsion are often used synonymously but it should be kept in mind that emulsions result when immiscible liquids are mixed whereas in a colloid solution it can be a liquid or solid dispersion in another liquid. In other words, an emulsion can be termed as a colloid but all colloids are not emulsions.

Difference Between Emulsion and Suspension

A few factors that can help differentiate between suspension and emulsion are:

- **Phases:** In a suspension, you can find two substances of any phase of matter like solid, liquid, and gas. At the same time, an emulsion consists of only two immiscible liquids.
- **Separation:** Where suspensions are convenient to separate, emulsions may or may not be separated. This happens due to the state of matter in which particles are present in either of them. As suspensions consist of solid-phase particles, they don't show any trouble during parting away. On the other hand, emulsions have two liquid phase particles. So we first have to check the type and nature of these liquids to say whether or not they can be separated.
- **Stabilization:** Stabilization is only possible in emulsions where you can use an emulsifier to make an emulsion more stable.

Difference Between Suspension and Colloid

Let's explore some of the primary differences between colloids and suspensions.

- **Particle Size:** The very first difference between the two is the size of the particles found in them. Where colloids have particles sizing in the range of 1 to 1000 nm, suspensions consist of particles above 1000 nm size. Plus, colloids have particles dispersed, whereas suspensions have particles suspended in the solution.
- **Separation:** Separation in suspensions is quite convenient due to the large size of particles. You can leave the compound standing somewhere, and the bigger suspended particles will settle down. On the other hand, emulsions show no such property. Due to their small-sized dispersed particles, the separation becomes a little challenging.

Another contrasting point here is the reaction to filtration. Where suspension particles get separated with filtration, there is no effect of the technique on the emulsion. Hence, separation of particles of emulsions isn't easy.

- **Light Scattering:** You can observe the scattering of light in emulsions due to the Tyndall effect. However, suspensions may or may not scatter light. It highly depends on whether or not they are opaque.

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Dispersion Solutions

Apart from all these, you may also hear the term dispersion solutions. These systems basically have two materials. They get created when the first material's distributed particles are dispersed in the second material's continuous phase.

If the dispersed particles are large enough to undergo the process of sedimentation, the system is called a suspension. In case the particles are small and don't react to sedimentation, they are known as the colloids. Similarly, the dispersion can be divided into various other systems based on the size of particles dispersed in the continuous phase.

We hope you understood these terms and can use them appropriately! Want to learn more about the laboratory terms, [register for our courses](#).

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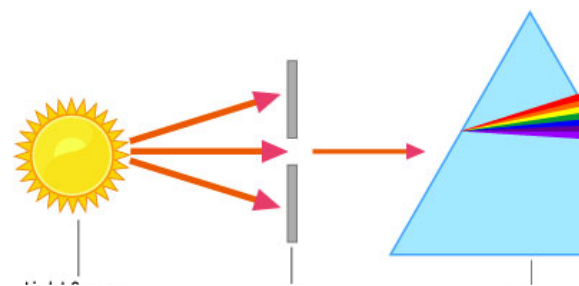
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