

Quick Guide To Solubility

Knowing your solubilities is important when formulating your own products. It is handy to know what is oil soluble, what is water soluble, and what is partially soluble or insoluble, or even soluble in other substances such as alcohol. The vast majority of natural ingredients are either water soluble or oil soluble.

The solubilities of ingredients will help guide your formulation in terms of the water phase, oil phase and if you require additional ingredients such as emulsifiers to bring your ingredients together.

Terminology

In chemistry, the substance that you want to dissolve in something is called the solute, and the 'something' is called the solvent. But don't worry too much about these terms. Mostly we will refer to the solvents and solutes as substances that are 'water-based', 'oil-based', 'alcohol-based', etc.

The degree to which the solute is able to dissolve in the solvent is called solubility.

It is also possible for solutes to mix together (or not), and for solvents to mix together (or not, in the most well known case of water and oils).

Water Soluble Ingredients

Water is probably the most common solvent in natural cosmetics. Water based ingredients will be soluble in water as well as in other water based ingredients. For instance you can happily mix plain water, [hydrosols](#), water-based botanical infusions, [aloe vera gel](#), [vegetable glycerine](#), [hyaluronic acid](#) and a whole host of other water soluble ingredients together.

Certain vitamins are also water soluble, such as [Vitamin C \(ascorbic acid\)](#) and Vitamin B.

Gum or cellulose thickeners such as [xanthan gum](#), [guar gum](#) and [hydroxyethyl cellulose](#) are dissolvable in water to form gels.

[Titanium dioxide](#) is water dispersible.

Botanical extracts are water soluble.

Alpha hydroxy acids (AHAs) such as [citric acid](#), [lactic acid](#) and [malic acid](#) are water soluble.

Specialised ingredients such as [marine collagen](#), [hydrolyzed wheat protein](#), [keratin](#) and [D-panthenol](#) are all water soluble and are added to the water phase.

[Baking soda](#), [sugar](#) and [salt](#) are soluble in water (see more under partial solubility below).

Water soluble ingredients will always go in the water phase of your formulation.

Oil Soluble Ingredients

Oil is another very common solvent in the cosmetics world.

All types of [oils](#) and [butters](#) are soluble in other oils, including [essential oils](#) and carrier oils.

Certain vitamins are also oil soluble, such as Vitamin A and [Vitamin E](#).

[Lecithin](#), [lanolin](#), [rosehip wax](#), [squalane](#), [beeswax and plant waxes](#) are oil soluble.

[Emulsifying waxes](#) and ingredients such as [stearic acid](#), [vegetable cetyl alcohol](#) and [cetostearyl alcohol](#) are also oil soluble and will be added into the oil phase along with other oils.

Oil soluble ingredients will always go into the oil phase of your formulation.

Alcohol Soluble Ingredients

[Alcohol](#) is a powerful solvent and it can also be used as a solubilizer, to dissolve small amounts of oils such as essential oils so that they can be added to water with no separation.

Small amounts of certain carrier oils and essential oils are soluble in alcohol (eg. in an alcohol-based air freshener).

Alcohol is commonly used to make alcohol-based botanical extracts and tinctures.

Partially Soluble Ingredients

Partially soluble ingredients are pretty self explanatory: they can only partially dissolve in a solvent/base. The most common example of a partially soluble substance is allantoin.

[Allantoin](#) - 0.5% soluble in water.

Certain substances do dissolve in water but have an upper limit after which no more will dissolve (sometimes heat can increase this limit). Examples are [sugar](#) and [salt](#). Sugar has a higher solubility than salt but eventually it will saturate the water and you just won't be able to dissolve more.

Insoluble Ingredients

Insoluble ingredients cannot dissolve at all. They can still be mixed into formulas though, and serve a myriad of purposes. Here are some common insoluble ingredients:

Micas and [iron oxides](#) are insoluble.

[Zinc oxide](#) is insoluble but can be dispersed in heavy creams.

[Clays](#) will form a suspension in water and will form a paste if only a little water is used, however they are not soluble.

[Botanical powders](#) - these don't dissolve in anything but you can make infusions or extracts out of them.

[Arrowroot powder](#) is insoluble but is often added to cut greasiness and give a silky skin feeling.

[Activated charcoal](#) is insoluble.

Exfoliating elements such as [apricot grinds](#), clays, [oats](#) and [seeds](#) are all insoluble.

Sugar is not soluble in oil.

Salt is not soluble in oil.

Soluble in Surfactants

You may notice that [surfactants](#) can have emulsifying or solubilising properties. You can add limited amounts of oils straight into surfactants and the water phase and when you mix it all up, everything will be blended (it will most likely turn whitish - you've essentially made an emulsion).

Can You Mix Water Soluble & Oil Soluble Ingredients Together?

Yes you can, but you will require an emulsifier. Oils and water don't mix, and likewise, oil soluble and water soluble ingredients do not play well without the assistance of an emulsifier. You can read all about emulsifiers in [A Quick Guide To Emulsifiers](#).

Can You Mix Insoluble Ingredients With Soluble Ingredients?

Using insoluble and soluble ingredients together yields some unique products! You can really get creative when combining these two ingredient categories. Below are just a couple of examples where insoluble and soluble ingredients are used together.

If you are making a scrub you will mix oils with ingredients such as clays, botanical powders and exfoliants to make a granule-rich formula that will be exfoliating. You could also incorporate an insoluble exfoliating element into a surfactant formula.

A clay face mask likely employs both insoluble clay as well as water soluble elements such as plain water or a hydrosol, honey, etc.

The oxides are often used as colourants by infusing into oils, leeching their colour.

Botanicals can be used to make infusions and teas and the plant matter is then strained out.

Arrowroot powder is incorporated into creams and lotions to reduce greasiness and provide a silky skin feel. It is also used in DIY deodorants.

We hope you learnt a thing or two on solubility!