

The Chemistry of Acrylics

Creating the perfect set of acrylics could be considered an art, but the foundation behind it is found in the science.

Liquid & Powder: The Basic Chemistry

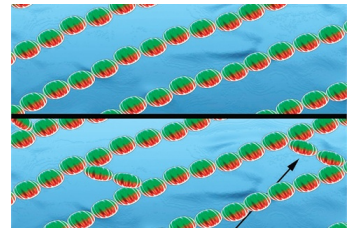
Liquid: a monomer made mostly of ethyl methacrylate (EMA), sometimes also including other monomers and additives. A monomer (“mono” means one; “mer” means unit) is a simple molecule that is the building block for polymer chains.

Catalyst: a substance that makes the chemical reaction occur faster than it otherwise would. (It speeds up breakage of the initiator in the powder.)

Inhibitors: ingredients, typically hydroquinone, hydroquinone monomethyl ether, or butylated hydroxytoluene, that keep the monomers from joining into polymer chains before they are mixed with the powder, which would cause premature hardening.

Cross-linkers (optional): additives that let the monomers join together in a 3-D netlike structure, a stronger structure than the row of head-to-tail connections they would otherwise create.

UV absorbers (optional): additives that absorb UV light (which can cause enhancements to yellow) and change it into blue light or heat.



Flow Modifiers (optional): additives that reduce brushstrokes on the surface, causing them to self-level.

Wetting agents (optional): additives that make liquids more compatible with a solid surface, thereby improving adhesion.

*** A note on odourless acrylics:** More accurately described as “low odour” (because they still release vapours, even though they’re difficult to smell), odourless acrylics don’t use ethyl methacrylate. While ethyl methacrylate reacts quickly and creates a strong colour-stable enhancement, the monomers used to create low-odour products react slower and are not as colour stable. Because they react slowly, oxygen inhibits the cure at the surface resulting in a tacky layer called the “oxygen inhibition layer”.

POWDER: a polymer whose particles act as carriers for the below ingredients. A polymer (“poly” means many) is a long chain of monomers that have been chemically linked together.

Initiator: a molecule that absorbs extra energy and uses it to cause chemical reactions to occur; in acrylic powder, it’s benzoyl peroxide, which breaks in half when exposed to the heat of your salon or your client’s finger. Concentrations of benzoyl peroxide vary widely from manufacturer to manufacturer.

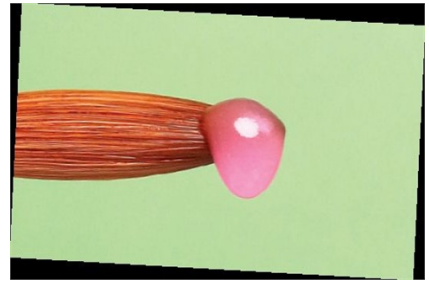
UV absorbers (optional): additives that absorb UV light (which can cause enhancements to yellow) and change it into blue light or heat.

Colorants (optional): dyes that give the powder a pinkish colour. Blue colorants act as an optical brightener, which means it makes other colours appear brighter.

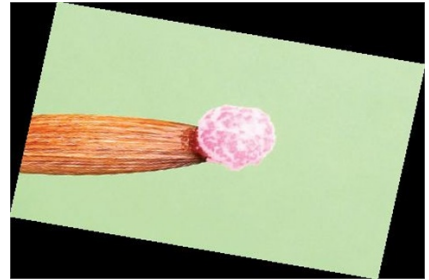
Titanium Dioxide (TiO₂) (optional): a mineral that serves as a whitening pigment. It is used for white, not clear, powders.

The Goldilocks Complex (Too Wet, Too Dry, Just Right)

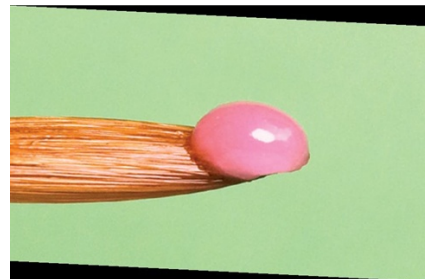
TOO WET (too much monomer liquid) — When the monomers link to each other during the chain reaction, they hug each other tightly, causing the nail enhancement to shrink. When you work with too much monomer, all of that extra monomer links together and you have excessive shrinkage of the enhancement (making it prone to lifting, tip cracking, etc.).



TOO DRY (too little monomer liquid) — When it polymerises, the monomer holds everything together. When you don't have enough, it's like trying to make a cake with too little milk.



JUST RIGHT (manufacturer-recommended ratio of monomer liquid-to-polymer powder) — When the monomer polymerises, it surrounds each bead of polymer powder. The powder works to stop cracks, reinforcing the enhancement. When you work with the correct ratio, you have enough crack-stoppers to create a durable enhancement.



* **A note on fast-set acrylics:** fast-set acrylics contain more initiator and/or catalyst, which is why they set up faster. You may be tempted to use a too-wet ratio with these products to slow down their setting time. Don't take this route, because the above rules still hold true. Switch to standard acrylics instead.

* **A note on coloured acrylics:** coloured acrylics include additional finely ground colorant powders. This sometimes causes them to need a slightly wetter working ratio, but make sure to check the manufacturer's instructions first.

Chain Reaction

liquid mixed with powder -> the catalyst (in the liquid) breaks the initiator (in the powder) in half, creating two free radicals-> each free radical combines with a monomer, energising it -> the energised monomer attaches to another monomer creating a covalent bond (the strongest type of chemical bond) >energy passes to the new partner monomer -> the second monomer attaches to another monomer creating a covalent bond, and on, and on, and on, creating long polymer chains -> the chains wrap around and encase each polymer powder bead, fusing the beads into the acrylic nail ->the reaction ends when there are no monomers remaining

PRIMER: a substance that has the ability to bond both to the nail and to other acrylics, making the nail plate more compatible with the enhancement product. The priming agent is typically dissolved in a fast-drying solvent like acetone or ethyl acetate.

Acid-based primer: primers that contain methacrylic acid, whose molecules have two arms each. One arm develops a hydrogen bond (a temporary bond) to the keratin surface, and the other arm undergoes a chemical reaction and creates a covalent bond (the strongest chemical bond) that links the primer molecule to the nail enhancement.

Mild-acid primer: primers that contain an acid that's gentler than methacrylic acid (which is highly corrosive) and improve adhesion by creating many temporary, hydrogen bonds between the nail enhancement and the natural nail. These are sometimes erroneously dubbed "non-acid" primers. (Acidbased and mild-acid based primers can yellow enhancements.)

Acid-free primer: primers that contain no acid components and work via both arms of their molecules creating strong covalent bonds between the nail plate and the enhancement. They are non-corrosive and don't yellow enhancements.

Primerless acrylics: adhesion promoters, like specific acrylic monomers or other additives, are added to replace the need for primers.

* **A note on pre-primers:** applied before a primer, a pre-primer makes the nail surface more alkaline, thereby increasing the effectiveness of the primer.

ACETONE is a solvent, meaning it dissolves other substances (known as solutes).

When you file down the enhancement before soaking it in acetone, it helps the solvent work in two ways: 1) there's less product to remove, and 2) rough surfaces have more exposed surface area for the solvent to be absorbed into.

Once the acrylic nail is in the acetone, the acetone swells the polymer network until it breaks into pieces. It will be removed even faster if you scrape away pieces of softened polymer with a stick or other implement.

As a general rule of chemistry, solvents work better when they're warm (think of how sugar dissolves faster in hot water than in cold water). But keep in mind that acetone, like most solvents, is volatile, increasing the risk of fire or lower air quality when not handled safely. Therefore, if you choose to warm acetone, DO NOT use a stove, microwave, or any open flame. Instead, place a plastic bottle with the acetone under hot running water or simply use the client's body heat by soaking a cotton ball with acetone, placing it on the enhancement, then wrapping the cotton and finger with aluminium foil.

Solvents can become saturated (meaning they can't dissolve any more solute), so make sure to always use fresh acetone on each client.