The Beauty Brains

Real Scientists Answer Your Beauty Questions

Guide To How Beauty Products Work

Volume 1

What's This All About?

Hey lucky readers! Sarah Bellum here to say hello and to welcome you to our first ever Beauty Science Guide.

This handy dandy collection of Beauty Brains brilliance teaches you all about the real science of cosmetics. Can you feel the excitement? Yes, that's right, it's all spelled out right here in the pages that you hold in your trembling hands.

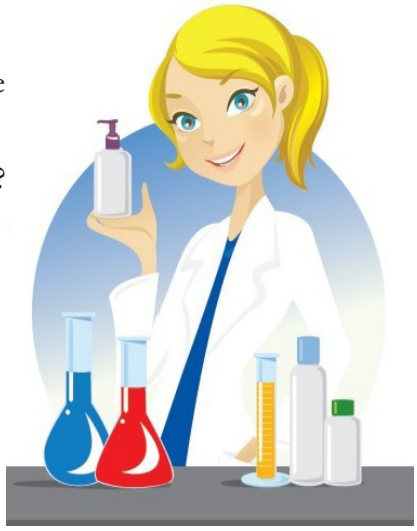
[Editorial note from Left Brain: Sarah, since this is not a paper document, the readers are not actually holding it in their hands; they are viewing it on their computer screens.]

Thanks Lefty, I think they get my drift. Pardon me for waxing poetic!

Anyway, as I was saying, this guide explains how 8 different kinds of beauty products work.

Only 8 you say? Why not more??

Because the Right Brain was too busy trying out a new shipment of "Pencil Me In" eyeliner pencils and didn't finish the sections on acne products and mineral makeup! Then we would have had 10 topics like I wanted...Oops, did I say that out loud?



Just joking, Righty! What I really meant was that these 8 articles are like a tiny teaser trailer for all the wonderful cosmetic knowledge that we share on The Beauty Brains blog every day, 365 days a year. So if you like what you see here, visit the blog for **more, more more!**

Why Should I Read This?

Isn't it obvious?

Knowledge is power, girl! And we're giving you a powerful peak behind the cosmetic industry curtain.

Wanna know which ingredients in lotion actually moisturize your skin? Curious why your shampoo feels like it's weighing your hair down, even though it's not a 2-in-1? Or do you just want to know the truth about aerosol hairsprays and the environment? Well, it's all here, spelled out for you in glorious black and pink.

[Editorial note from Left Brain: Sarah, the headline font color is actually designated as Maroon 44, not "Pink."]

Thanks for the oh, so helpful clarification, Lefty. As I was saying...

We think that the more you know about beauty science, the better you'll be at picking products that do what you want, at a price you can afford. So we put together this handy educational guide, that explains how common cosmetics actually work.

We talk about the ingredients used in the products, how they are made, and what they really do.

Plus it's all FREE!

[Editorial note from Left Brain: Sarah, technically the download is not free because of the cost of bandwith. However, even assuming a minimum download speed based on a landline modem connection, the actual cost is probably negligible.]

Not as negligible as all these pointless interruptions, Lefty. Now let me get on with the show!

What's Inside?

If you're familiar with the Beauty Brains blog, you already know we explain cosmetic science concepts in an easy to understand, entertaining style. If you're not already a fan of our blog, you're in for a treat! In the pages that follow you'll learn about the following products.

1. Shampoo
2. 2-in-1 Shampoo
3. Skin Lotion
4. Mascara
5. Lip Gloss
6. Eyeliner
7. Fragrance
8. Aerosol products

Ok, now you've got it, what are you waiting for? I envy you, you lucky devils (or should I say divas?) The secrets of the beauty universe await you, and all you have to do is turn the page.

[Editorial note from Left Brain: This is a PDF file, there are no paper pages to turn. The reader should be advised to scroll down to advance the text.]

Sigh What am I gonna do with you Lefty? Enjoy, everyone!

How Shampoos Work

Almost everyone on the planet uses shampoos. In fact, in the United States it's estimated that 98% of all people use shampoo. To really understand how shampoos work to clean your hair, it is best to first look at the major ingredients that are found in every kind of shampoo formula.

Types of shampoo ingredients

Shampoo ingredients can be broken down into the following 9 basic categories:

Diluent

Did you ever notice that the first ingredient on almost every shampoo is WATER? Well, the truth is that water makes up 70 to 85% of the entire shampoo formula. That's right, you are buying mostly water.

But that's a good thing becuase the ingredients that make shampoo clean, foam, and condition do not work very well when they are too concentrated. The diluent helps make them work much better. It also makes them less irritating.

Surfactants

Surfactants are the primary functional ingredients in shampoo. A surfactant is simply a type of detergent. Although sometimes surfactants are referred to as soaps, this is not exactly accurate. A soap is a special type of surfactant, but not all surfactants are soaps. Surfactants make the shampoo foam; they also dissolve grease and oil from your hair. Surfactants are commonly used in almost every type of cleansing product, from toothpaste to hand soap to body wash.

Thickeners

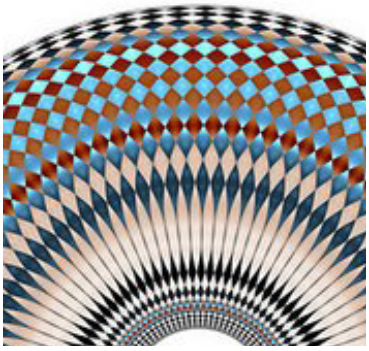
By themselves, shampoos would actually be pretty thin. But people don't really like thin products. They'd rather have something that comes out slightly thick and luxurious.

So, cosmetic chemists have to add ingredients that make the products look and feel thicker. Shampoos are typically thickened by a reaction between the surfactants and sodium chloride (common table salt). Formulators may also add special thickening agents known as polymers.

Preservatives

Preservatives are added to the formula to ensure the product doesn't become contaminated by bacteria, mold, or yeast. You really wouldn't want this! The most common preservatives include parabens and urea derivatives.

Color



A variety of dyes may be added to the shampoo to impart a pleasing color. In the vast majority of shampoos, the dye has no functional purpose - it's just there to make the shampoo look nice. However, there is a special sub-class of shampoos that are color-depositing. They contain special staining dyes that can help give the hair a little bit of color. They don't work too well but this is an area in which cosmetic scientists are trying to improve the formulas.

Conditioning Agents

A good shampoo not only cleans the hair, it moisturizes as well. The conditioning agents used in shampoos are usually polymers such as those derived from cellulose or guar, or silicones. Typically the silicone must be chemically modified to be soluble in the shampoo system. So called two-in-one shampoos that are supposed to work like using both a shampoo and conditioner, have higher levels of conditioning agents so a separate conditioner is not required. Unfortunately, these products don't deliver nearly the same conditioning effect as rinse-out conditioners.

Control Agents

Control agents are added to the formula to help adjust its physical properties. For example, an acid or base may be added to raise or lower the pH. Thickeners, as the name implies, control how thick or thin the product is. The scientific term for this

measurements a is "**viscosity**."

Fragrance

Fragrance is extremely important to a shampoo. In addition to covering the chemical odor of the product, a good fragrance support the image of the product. For example, research shows that consumers think a deep cleansing shampoo works better when it has a citrus fragrance. Moisturizing shampoos seem to condition better when they have a rich, "milky" fragrance. In future posts we'll deal with the impact of fragrances in cosmetics in more detail.

Featured Ingredients

Marketers frequently add featured ingredients to their formulations to make them more appealing or to support to a certain marketing story. In the deep cleansing shampoo example described above, one would expect to find a citrus extracts like tangerine peel or lemon zest in the formula. While these ingredients do serve to make the product more appealing, they typically do not perform any function.

The Making of a Shampoo

Now that you know all the ingredients in the shampoo and why they are there, you might find it interesting how these formulas actually make it into the bottle you gleefully take off the store shelf.

It starts in the lab

The process actually begins in the laboratory where cosmetic formulators blend small amounts of chemicals to understand how they behave when they're mixed together. Once the chemists have a formula and they're satisfied with their ability to make a few pounds of shampoo in the lab, they then translate these mixing instructions into a version suitable for making several thousand pounds in the manufacturing plant. This process of is "scaling up."

In the manufacturing plant, shampoo is typically made in big stainless steel tanks, as large as 3000 gallons. (That's over 20,000 bottles of shampoo!) These tanks have an outer shell that can be filled with either hot or cold water - that's how the batch is heated or cooled. The tanks also have mixing blades that turn the tank into kind of a giant blender.

Ok, now we've got a formula, instructions on how to manufacture it, and a giant blender. Let's make some shampoo!

Charging the tank

The first step is to fill the tank with some portion of the water, which is the solvent forflikr-showerhead.jpg the system - it dilutes the the rest of the ingredients to the proper concentration. A special type of water, known as deionized water, is used to ensure the product is as pure as possible. Depending on what else is in the formula, the water may be heated to make the other ingredients dissolve faster.

After the water, the other ingredients are added in a specific order. The surfactants are usually added early in the process. These ingredients range in consistency from being water thin to very jelly like. These may be dumped into the tank from drums or pumped in from other chemical storage tanks.

The surfactants usually need heating and mixing to fully dissolve.

Care must be taken when adding surfactants because they may cause excessive foam. (Remember these formulas and ingredients are detergents and they're supposed to make foam.)

Heating and cooling

As the batch reaches its peak temperature, any solid ingredients that require melting may be added. These include opacifiers (ingredients that give the shampoo a pearly appearance)

and certain conditioning agents. Once all these ingredients are thoroughly mixed together, the batch is cooled by pumping cold water through the tank's outer shell.

As the batch continues to mix the cold water cools the shampoo and the product begins to thicken.

Once the batch is sufficiently cooled the rest of the ingredients are added. Some ingredients, like fragrance, botanical extracts, and preservatives have to be added at the end because they might break down when exposed to heat. Adding these ingredients in the wrong order can result in a product that either doesn't smell right or one that will grow too much bacteria.

And you really don't want bacteria growing in your shampoo do you?

Checking the specifications

After the bench is finished, adjustments may be made using the control agents. To make sure that every batch of product is the same (or at least ALMOST the same) every product has a set of predetermined specifications. These specifications ensure the product has the right odor , appearance , viscosity, etc. If the product is "out of spec," control agents maybe added to adjust it. For example , if the shampoo is too thin more salt maybe added to the batch to thicken it.

Filling the bottles

Upon final approval the batch is then pumped through a series of pipes to the filling equipment which puts the product in the bottles. Most modern manufacturers have a fully automated process in which the bottles travel down a conveyor line, pass under a filling head that squirts product into the bottle. Then they move down the assembly line to a capping machine that applies the closure. Finally, the bottles are boxed and placed on a pallet for shipping to stores. From there, next stop: your bathroom!

How Do Shampoos Clean Your Hair?

Now that you know the ingredients in the shampoo and how they are put together, the only thing left is to tell you how these products actually work to make your hair look fabulous.

Dirty Tricks

The reason you want to wash your hair in the first place is because it's dirty - but how does it get dirty? There are several ways...

The sebaceous glands in your scalp secrete natural oils (kind of chemically similar to olive oil) that make your hair feel greasy.

Then you've got perspiration which deposits salts and other junk on your hair and scalp.

On top of that mess you have smoke, pollution, and dust that your hair picks up from the environment.

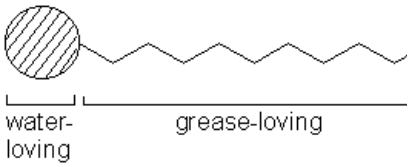
And let's not forget the styling residue from hair spray, gel, mousse, and putty you might have used. Now, you might think that getting this stuff off your hair would be simple, but the process of cleansing is really ingeniously sophisticated.

Wash and wear

For the most part, all this residue on your hair is not very water soluble - in other words if you just rinse your hair in water you wouldn't get rid of it all.

Enter the shampoo with its surfactant (aka detergent) molecules. These molecules are designed to remove these water insoluble contaminants by working as tiny chemical bridges. (They link oil and water together.)

If you were to look at these molecules under a microscope , you would see they consist of two parts: One end of the molecule is attracted to water, and at the other end to oil. This structure gives surfactants the unique ability to combine oil and water and it also allows them to create foam as well. This handy little piece of chemistry is one of the most important properties of cosmetic ingredients.



So, when the shampoo is applied to your dirty hair, these tiny chemical cleansers spring into action and "seek out" the drops of oil, dirt, and yesterday's Sebastion hair spray. The surfactants actually surround these contaminants and lift them off your hair. Once all the undesirable dirt is lifted off your hair the surfactants keep it suspended in the rinse water so it goes down the drain, not back on your hair.

Shampoo plus conditioner

Now that you've learned how shampoos work, you're ready for the advanced material: how do 2-in-1 shampoos work?

Undoubtedly, the best 2-in-1 technology was created by the good folks at P&G back in the mid 1980's. One of the original patents is US #4788006. This technology led to the phenomenal success of a shampoo called Pert Plus. That shampoo is still around but sales have been withering ever since Pantene was introduced in the mid 1990s.

> ***"Ironically, except for the fragrance and color these formulas are very much the same."***

2 in 1 shampoo technology

So what is this 2 in 1 technology? Essentially, it is two ingredients added to a regular shampoo, a silicone and a suspending agent. The silicone, usually an ingredient called Dimethicone, is what makes the formula conditioning. The suspending agent is Glycol Distearate and it is what keeps the silicone from separating out of the formula. The way it works is this: when the bottle of shampoo is sitting on the shelf, the suspending agent

is able to hold the silicone in the formula. But when you put the shampoo on your head and mix it with water, the suspending agent does not work so well.

The silicone separates out, stays behind on your hair where it can provide conditioning. That's the theory anyway and it actually works.

Regular or 2 in 1 - The difference isn't always clear

Now that you know a bit about the technology, let's do a comparison of a 2 in 1 shampoo and a "regular" shampoo. To make the comparison most useful, we'll look at a products made by the same brand.

Here are two ingredient lists. One is a 2 in 1 - Pantene Pro-V Shampoo + Conditioner The other is a shampoo from the same line Pantene Classically Clean

Pantene 2-in-1 Shampoo

Water, Ammonium Laureth Sulfate, Ammonium Lauryl Sulfate, Glycol Distearate, Sodium Chloride, Cocomide MEA, Dimethicone, Cetyl Alcohol, Fragrance, Sodium Citrate, Polymethacrylamidopropyltrimonium Chloride, Sodium Benzoate, PEG-14M, Dihydrogenated Tallowamidoethyl Hydroxyethylmonium Methosulfate, Disodium EDTA, Citric Acid, Panthenol, Panthenyl Ethyl Ether, Methylchloroisothiazolinone, Methylisothiazolinone, Ammonium Xylene-Sulfonate

Pantene Regular shampoo

Water, Ammonium Laureth Sulfate, Ammonium Lauryl Sulfate, Glycol Distearate, Cocamide MEA, Panthenol (Pantene Pro-Vitamin Complex), Panthenyl Ethyl Ether (Pantene Pro-Vitamin Complex), Lysine HCl (Pantene Amino Protein Complex), Methyl Tyrosinate HCL (Pantene Amino Protein Complex), Histidine (Pantene Amino Protein Complex), Dimethicone, Fragrance, Cetyl Alcohol, Sodium Citrate, Sodium Chloride, Sodium Benzoate, Guar Hydroxypropyltrimonium Chloride, Disodium EDTA, Hydrogenated Polydecene, Trimethylolpropane Tricaprylate/ Tricaprate, Citric Acid, Methylchloroisothiazolinone, Methylisothiazolinone, Ammonium Xylene-Sulfonate

Notice any similarities? The first 4 ingredients are exactly the same. But more importantly, both contain the 2 in 1 technology, Glycol Distearate and Dimethicone.

Just so you don't think we're picking on Pantene, other brands do the same thing for example Fructis (their 2 in 1 vs their normal both contain Dimethicone).

And even your favorite salon brands do it. Just look at the ingredient list of Charles Worthington shampoos.

So why do these companies add 2 in 1 technology to regular shampoos? Mostly because the added conditioning helps prevent the hair from being so clean that it feels dry. Almost any shampoo will do an excellent job of removing the oil and dirt from your hair. Take out too much however; you'll get a head of hay.

Don't Like 2-in-1 shampoos?

If you want a clarifying or normal shampoo then DO NOT use one that contains Dimethicone. Despite what it says on the label if a shampoo contains Dimethicone it is probably a conditioning shampoo.

How Skin Lotions Work

Your skin is a wonderful organ but sometimes it'll dry out and feel awful. Fortunately, clever cosmetic scientists have figured out how to make lotions you can run on your skin to make it feel and look better. To understand how these things do that, we need to first look at the ingredients used to make them.

Types of skin lotion ingredients

Here are the 10 main categories of cosmetic ingredients used in a basic lotion:

Solvents

The most widely used lotion ingredient is water, which is the solvent for the rest of the ingredients as well as a moisturizing agent. Deionized water is typically used to ensure the products purity.

Skin moisturizing agents

The main purpose of the product is to moisturize, so it's not suprising that there are a large number of ingredients to perform this function. In general, they work in two different ways - which we'll discuss later. Some examples from Vaseline include glycerin, petrolatum, and dimethicone.

Emulsifiers

Lotions primarily owe their magical moisturizing properties to their ability to deposit oily materials on the skin. Because oil and water ingredients don't like to mix , lotions use ingredients called emulsifiers to help them combine. Common emulsifiers include Glyceryl Stearate, Cetyl Alcohol, Stearic Acid, Glycol Stearate, and Sodium Stearoyl 2 Lactylate.

Skin Emollients

"Emollient" is just a fancy way to describe an ingredient that helps the lotion spread and that makes skin feel smooth and lubricated. Chemically, these ingredients are called esters and an material like Isopropyl Palmitate is typically used.

Thickeners and Stabilizers

Because the oil and water soluble ingredients tend to separate over time, thickeners and stabilizers are added to the lotion to help hold it together better. Commonly used thickeners include natural materials like guar, gum arabic, Magnesium Aluminum Silicate, and cellulose as well as synthetic acrylic polymers, like Carbomer.

Preservatives

Preservatives are added to the formula to ensure the product doesn't become contaminated by bacteria, mold, or yeast. Common preservatives include parabens and urea derivatives. Currently, Vaseline uses Methylparaben, DMDM Hydantoin, and Iodopropynyl Butylcarbamate.

Color

A variety of dyes maybe added to lotions to impart a pleasing color. In the vast majority of lotions, the dye has no functional purpose at all - it's just there to make the product look nice. There are some lotions that are designed to give your skin color - these include higher levels of special dyes and pigments or reactive compounds like DHA used in sunless tanners.

Control agents

Control agents are added to the formula to help adjust its physical properties. For example, an acid or base may be added to raise or lower the pH. Vaseline has Disodium EDTA, Triethanolamine, and Lactic Acid.

Fragrance

The type of fragrance used in lotions is important for a couple of reasons. First, it has to smell appealing to you or you won't like the product. Too much or too strong of a

fragrance and it will clash with your perfume; too little or too weak of a fragrance and you may smell some of the chemical odor of the product. Second, the fragrance must be non-irritating because it will be in contact with your skin for a long time. And third, the fragrance should support the image of the product - if it's a cucumber melon lotion, it should probably smell like cucumber or melon.

Featured ingredients

Marketers frequently add featured ingredients to their formulations to make them more appealing or to support a certain marketing story. For example, lotions that are marketed as "natural" products will typically feature more botanical extracts, even though these extracts don't necessarily make the product work any better.

And "sciency" sounding lotions will contain long chemical names like "Hydroterilium" that sound like they MUST be doing something, even though they're probably not. The main purpose of these kinds of ingredients is to make the product more appealing. In Vaseline you'll find Tocopheryl Acetate (Vitamin E Acetate), Retinyl Palmitate (Vitamin A Palmitate), Avena Sativa Kernel Protein (Oat), Glycine Soja Oil (Soybean), and Helianthus Annuus Seed Oil (Sunflower).

How Do Lotions Moisturizer Your Skin?

Now that you know about all the ingredients in the skin lotion, you can better understand what they do when you use them.

But first a quick primer on the biology of skin.

Skin is a living organ made up of two primary layers, the dermis and the epidermis. The dermis is where all the cell growth happens. New cells grow and push the old cells out towards the surface of your skin. As the cells get pushed out they lose their viability

and die. The dead cells enter a layer called the epidermis and eventually get to the surface where they are flaked off. These dead skin cells are what you remove through exfolliation.

Skin does an excellent job of protecting your inner organs from the damaging factors in the environment such as chemicals, disease-causing microbes, radiation, etc. It also provides sensation, helps give you shape, cool you down with perspiration, produce vitamin D and regulate your body's water content. All that and it doesn't cost you a cent! Too bad cosmetics and personal care products aren't so versatile.

It is the last factor (regulating water) for which the skin needs a little help.

You see, the water or moisture level in the skin is dependant on both your internal moisture level
and the external environmental moisture level. When it is dry outside, water in your body is drawn to the surface of your skin where it evaporates. This leaves skin feeling dry, itchy and uncomfortable.

Conversely, when the weather is humid the water in your skin doesn't evaporate as easy so your skin feels nice and moisturized. This is why skin moisturizers are used most often (and work best) during dry, cold weather. In fact, sales of lotions in the winter months are signficantly more than those
in all other months combined.

Keeping the water in your skin

Skin moisturizers are applied directly to the skin and rubbed until some of the ingredients absorb into the top layers, while the rest form a thin film on the surface.

The film created inhibits water from escaping and is one method that they work to moisturize. This method is known as occlusion. With the film in place, water from inside your body can't make its way out to the atmosphere. Thus, your

skin stays soft and supple. The other way that moisturizers work is by loading your epidermis up with humectants. These compounds attract water and help hold water in your skin.

Eventually, skin moisturizers stop working as the film either gets damaged or the ingredients are sloughed off through shedding. This is why you need to reapply and also why you don't have to worry about chemicals from your lotions getting into your body.

All About Mascara

First a quick bit of background - we know that mascaras have been around since at least 4000 BC because historical records show that Egyptians used charcoal and other minerals to darken their lashes and eyelids. In modern times, mascara first appeared in the form of a pressed cake that was applied by wetting a brush, rubbing it on the cake, and than applying it to eye lashes. The cake consisted of a mixture of black pigments and soap chips.

The next innovation in mascara involved a lotion like version of the soap cake that was packaged in a tube and squeezed onto a small brush to apply. Mascara as we know it today was created in the 1960s with the invention of a grooved brush that could apply a consistent amount. This is the basic form that's still used today.

How to Make Mascara

The primary ingredients in mascara are pigments - the chemicals that provide color. Because U.S. Federal regulations only allow certain colorants to be used in area of the eye, only natural colors and inorganic pigments are used. Carbon black and iron oxides provide black, brown , and red colors; chemicals Ultramarine blue provide blue and green shades.

These pigments are mixed together in a cosmetic base that is an emulsion of oils , waxes, and water. For examples of these waxy ingredients, let's look at Maybelline Great Lash:

> Water, Beeswax, Ozokerite, Shellac, Glyceryl Stearate, Triethanolamine, Propylene Glycol, Stearic Acid, Sorbitan Sesquioleate, Methylparaben, Quaternium-15, Quaternium-22, Simethicone, Butylparaben, Iron Oxides (may contain), Titanium Dioxide (may contain), Ultramarine Blue (may contain)

The Beeswax, Ozokerite, Stearic Acid, and Shellac provide the main body of the mascara and give it it's waterproof and smudge proof properties. Glyceryl Stearate and Triethanolamine are added to make sure the mascara can be washed off.

The Propylene Glycol, Sorbitan Sesquioleate, and Simethicone, added as processing agents and help control the consistency of the product while Methylparaben, Quaternium-15, Quaternium-22, and Butylparaben are preservatives that keep the mascara free of "bugs" Finally, the Iron Oxides Titanium Dioxide Ultramarine Blue are the pigments.

These ingredients are mixed together in large metal kettles. Typically, the waxes and emulsifiers are mixed together and melted in one vessel and the water soluble ingredients are mixed in another vessel. Once the waxes are completely melted, the pigments are added. When both portions are sufficiently heated and mixed , they are blended together to form the final product. A device known as a homogenizer is used to make sure all the pigment particles are properly dispersed.

Once the mascara is finished mixing, it is transferred to a filling machine that pumps a metered amount into each glass or plastic mascara bottle. The brush or wand is inserted into the tube and a capping machine automatically twists it shut. The tubes are then packaged for shipping.

So how does mascara work?

This is really the simple part - when you stick the brush into the mascara tube and pull it out, a metering ring built into the orifice scrapes off the excess mascara so the brush has a controlled dose on it. So, when you brush your eye lashes, just the right amount gets

delivered to each tiny hair fiber. The waxy nature of the mascara helps form a relatively thick coating that, due to the high wax concentration, is very water proof. That's how a good mascara can resist smudging and bleeding . The result - your eye lashes get a nice splash of color and they look much plumper.

How Lip Gloss Works

Most lip glosses are in the form of a gel but some companies do make a stick or pomade version. Regardless of the form, these products are all designed to give your lips a little shine and color. (They taste good too!)

Ingredients in Lip Gloss

Typically these formulas are oil based and don't contain any water so there's no need for emulsifiers (chemicals that help water and oil mix together.) Let's take a closer look at the 5 basic ingredients used in lip gloss.

Emollients/shine agents

Many, many different ingredients can be used as shine agents. Most of the formulas we surveyed used oils (either mineral or vegetable based), lanolin derivatives, or polybutene (a type of hydrocarbon that mimics silicones. Surprisingly we don't see many silicones used in lip glosses.)

Thickeners

These ingredients keeps the gloss from dribbling down your chin when you apply it. Waxes (like ozokerite) and clays (like kaolin) are commonly used.

Colorant/Glitter

While you can make a colorless lip shine, most glosses do contain some kind of colorant. Typically this is either an FD&C dye (did you know that stands for Food Drug & Cosmetic?), or an iron oxide (for earthy colors). Mica (a type of mineral based glitter) can also be used for sparkle.

Flavor

What would lip gloss be without all those yummy flavors? The formula may also contain a sweetening agent like sodium saccharin.

Control agents

These are the ingredients that formulators add to lip glosses to ensure the product remains stable. Examples include pH adjustors, preservatives, and anti-oxidants.

You should also know that some lip glosses include sunscreens.

Source: Here are the lip glosses we examined when compiling this ingredient review.

Archipelago Botanicals White Sugar & Mango Lip Gloss

Arissa Lipgloss

Bonnie Bell Lip Lights

CoverGirl Lipslicks Lip Gloss

e.l.f. Super Glossy Lip Shine

Neutrogena MoistureShine Gloss Flirt

Palmer's Cocoa Butter Formula Vitamin E Lip Gloss

Philosophy Very Emollient Lip Shine Cinnamon

Revlon SuperLustrous Lipgloss Pink Afterglow

How Eyeliner Works

Types of Eyeliners

Eyeliners are formulated into two basic types: pencils and liquids. While the details vary, both types use these same basic ingredients.

Basic Ingredients
The Base is the backbone of the formula. In the case of pencils, its the waxy/greasy matrix that forms the core of the pencil; in the liquids its the water/oil emulsion in which the rest of the ingredients are suspended.

Typical base ingredients include waxes and oils, emollients (spreading agents) and in the case of liquid type, water and emulsifiers.

Colors
Colorants used in eyeliners (and other cosmetics used around the eye) must be approved by the FDA (in the United States). Colorants that can be used in products for other parts of the body aren't necessarily safe enough to be used around your eyes.

Typical colorants include iron oxides and ultramarine pigments. Carmine is another colorant you see from time to time. It's a red color made from crushed insect bodies. Mmmmm!

Control agents
These are added to eyeliner formulations to make sure the product meets specifications when it's manufactured and that it maintains high quality after manufacture. These include chemicals that control the pH, or acid/base balance of the product, and that keep the product free of bacteria and mold. In some oil based formulas, an antioxidant may be added to keep the waxes and oils from going rancid. Typical control agents

include tocopherol (also known as vitamin E) used for its antioxidant properties as well as Citric Acid, Methylparaben, and Propylparaben.

Featured ingredients
Several things can be added to eyeliners to make them more appealing to consumers. These ingredients don't change the way the product works or the way it looks, but marketers add them because women think they are helpful.

For some reason aloe vera is a very typical featured ingredient. It doesn't do anything but it sure sounds nice to people.

Now you know, what next?

There are two ways that understanding eyeliner ingredients could be helpful. Let's say your favorite eyeliner is being discontinued. If you know what kind of base ingredients to look for, you might be able to pick a replacement without having to try so many new products.

On the flip side, if you're getting irritation or an allergic reaction to your eyeliner, you might be able to figure out what ingredients to stay away from when you shop for a new one.

Now, if you're really into this, you can practice reading ingredient lists with the following examples of popular brands. Or you just scroll to the end:

Maybelline Line Stylist Eyeliner (Automatic pencil type)
Base:
Isododecane, Cetyl PEG/PPG-10/1 Dimethicone, Cera Alba/Beeswax, Carnauba/ Carnabua Wax, Trimethylsiloxysilicate, Hydrogenated Palm Kernel Glycerides, Isoeicosane, Hydrogenated Palm Glycerides, Isopropyl Palmitate Silica, Calcium Aluminum Borosilicate,

Colorants:
Titanium Dioxide, Chromium Oxide Greens, Manganese Violet, Bismuth Oxychloride, Chromium Hydroxide Green, Ferric Ferrocyanide, and Carmine

Control agents (pH, preservatives):
Methylparaben, Propylparaben, Ethylparaben, Tocopherol

Featured ingredients:
Retinyl Palmitate, Aloe Barbadensis Extract

Revlon Colorstay Eyeliner (Pencil type)
Base:
Cyclomethicone, Trimethysiloxysilicate, Ozokerite, Polyethylene, Phenyl Trimethicone, Euphorbia Cerifera Wax (Candelilla), Lecithin,

Colorants:
Iron Oxides, Titanium Dioxide, Mica, Ultramarines, Chromium Oxide Greens, Ferric Ferrocyanide, Bronze Powder, Carmine, Chromium Hydroxide Green, Copper Powder, Manganese Violet, Ferric Ammonium Ferrocyanide

Control agents (pH, preservatives):
Sorbic Acid, Citric Acid, Methylparaben, Propylparaben, Tocopherol

Featured ingredients:
Ascorbyl Palmitate

Maxfactor Linemaker waterproof eyeliner (brush applied liquid)
Base:
Water, Butylene Glycol, Alcohol, Oleic Acid, Dioctyl Sodium Sulfosuccinate, Oleth 20, Bentonite

Colorants:
Iron Oxides, Carmine

Control agents (pH, preservatives):
Phenoxyethanol, Methylparaben, Ethylparaben, Propylparaben, Butylparaben, BHA, Quaternium-15, , Sodium Bicarbonate,

Featured ingredients:
None

L'oreal Intensifique Liquid eyeliner (Liquid type)
Base:
Water/Aqua, Propylene Glycol, Acrylates Copolymer, Diglycol/CHDM/Isophthalates/ Sip Copolymer, Alcohol Denat., Trilaureth-4 Phosphate, Xanthan Gum

Colorants:
Iron Oxides Mica, Titanium Dioxide, Chromium Oxide Greens/, Ferric Ferrocyanide, Ultramarines

Control agents (pH, preservatives):
Imidazolidinyl Urea, Methylparaben, Propylparaben

Featured ingredients:
None

See, that wasn't so bad, now was it? Knowing what to look for can help you find the kinds of eyeliners that you like. Good luck!

How Fragrances Work

Fragrance is a mixture of fragrant essential oils and aroma compounds, fixatives, and solvents used to give the human body, objects, and living spaces a pleasant smell. In the context of beauty care products, fragrance really means two things.

First, it can refer to a scent that you wear on your body like Chanel, Dolce & Gabanna Light Blue, or Donna Karan Gold. This definition is the one most people probably think of first. But the term also refers to scents that are added to beauty products to cover the base odor of the chemicals and to make the products more exciting to consumers.

The terms fragrance, perfume, and cologne are sometimes used interchangeably but they don't necessarily mean the same thing. Strictly speaking, fragrance is a broader term covering all aroma chemical mixtures. Perfumes and cologne describe a specific type of fragrance that is worn on the body. (The term Cologne comes from the name of the German city where it was invented.)

Where Do Fragrances Come From?

While a fragrance can be a simple natural oil, (rose oil comes to mind for example) most fragrances are compounded from many ingredients some of which are natural and some of which are not. Who creates a fragrance?

You may be surprised to find the companies that sell hair and skin care products do not, in general, make their own scents. Even the companies that sell the perfumes mentioned above don't make their own fragrances. And no, Britney Spears did not make her Curious fragrance! Instead, fragrances are developed by companies that specialize in perfumery, known as fragrance houses. There are dozens (if not hundreds) of these companies around the world. The largest global fragrance suppliers include companies like Givaudan, International Fragrances and Flavors, and Firmenich. (By the way, these companies not only create fragrances but they are also responsible for developing most

of the flavors used in the food industry today).

Fragrance houses work with finished product manufacturers to create new scents for all kinds of beauty products. They are involved in every aspect of fragrance creation: from predicting the next hot fragrance trend, to understanding the science of chemistry, to consumer testing of new fragrance/product combinations. In most cases, this development work is carried by under the direction of the finished product manufacturer.

Beginning the Creative Process - The Fragrance Brief:
A brief is a document the finished product manufacturer provides to the fragrance house to direct the fragrance development. It establishes the objective of the project, the conceptual direction, and pricing parameters. In other words, tt tells the fragrance house everything they need to know to be able to create a new fragrance.

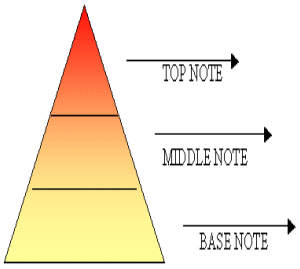
Once the direction for the project has been set, the actual fragrance development can begin. This work is done by highly trained perfumers who use a pallet of aroma chemicals to create new scents in the same way that an artist uses a color pallet to create a painting. Next, we`ll discuss how this fragrance creation process actually works.

Crafting the fragrance

Previously, we shockingly revealed a deep, dark secret of the beauty industry: most companies don't create their own fragrances. Instead, they hire specialized companies known as Fragrance Houses to do it for them. So what ingredients do these Fragrance Houses use to create all those wonderful scents? That's what we'll look at next.

Fragrance Structure

Fragrance notes are used to create a perfume the same way bricks are used to create a building. You start with a foundation, and you add layer after layer until you reach the top. A good fragrance is kind of built like a pyramid with a large, solid bottom layer and a smaller, lighter top.



Ingredients known as "bottom notes" form the base of a fragrance. These account for about 40% or 50% of the fragrance. Because these bottom notes are heavier, longer lasting scents you can still smell them even after you`ve been wearing a fragrance for hours.

The middle of the fragrance is the part you smell the strongest after you`ve been wearing it for 30 minutes or so. This section makes up about 30% to 40% of the fragrance and is usually a complex floral blend.

At the top of the fragrance pyramid, you'll find the lightest, fastest evaporating scents. These "top notes" make up about 20% of the fragrance and they are described with terms like "sparkling" and "fresh."
You smell them when you first open a bottle of perfume but they evaporate quickly once you apply it to your skin.

Types Of Fragrance Ingredients

There are thousands of fragrance ingredients that can be used as bottom, middle and top notes. Perfumers group them into the following categories :

Citrusy

As the name implies, these are derived from citrus fruits like limes, lemons, oranges and grapefruits. These are typically used as top notes to brighten a fragrance.

Floral

Flowers are the most popular of all fragrance scents - rose, tuberose, jasmin, freesia,

and lily are just a few of the many possible floral notes. In general, floral notes are diffusive and natural smelling. But they are also quite diverse - floral aldehydes tend to have a fatty odor; green florals are almost vegetable-like; and fruity florals are bright and sweet.

Fougere

Fougere is the term used to describe a group of fragrance notes that include certain citrus fruits, geranium and lavender. These notes are very crisp and clean smelling and are said to smell like fresh air or the outdoors. This type of scent is frequently used in men's colognes.

Fruity

In addition to citrus fruits, apple, peach, berry, and melon notes are also used as fragrance ingredients. The original Herbal Essences fragrance, for example, was built on a strong green apple note. These scents are very well liked and do a good job of covering up the odor of other chemicals in the formula. They are described as being sweet, fresh, and natural.

Herbal/Green

Herbal and green notes can be made from rosemary, sage, basil, and other similar plants. These also make good top notes because they diffuse very quickly. They are often described as fresh, clean and natural.

Oriental

Oriental notes typically include amber, frankincense, myrrh, incense notes, sandalwood, vanilla and fir balsam. These are heavy, long-lasting scents so they make good bottom notes. (Note : Oriental is a technical term, not to be confused with "Asian "which is the more politically correct term to describe ethnicity.)

Woodsy

Woodsy notes smell like cedar or pine. They tend to be heavy and long lasting so they make good bottom notes too.

We've barely scratched the surface with this short list of ingredients, but hopefully you'll be able to decipher at least some of the fragrance descriptions the next time you're shopping at Sephora. And now that you understand these basic building blocks of fragrance chemistry, you're ready for Part 3 where we'll talk about how perfumers combine these chemicals to make us all smell so sexy!

Building a Perfume

Perfumers design new fragrances based on a fragrance brief, a profile provided by the company requesting the new scent that describes the desired characteristics of the new fragrance. Based on this direction, the perfumers must select ingredients like those we talked about to build the fragrance with. As we saw, there are thousands of ingredients to choose from. Next, you'll learn about the process used to select these ingredients.

Selecting and Blending Ingredients

This selection process is part science and part art. A scientific background is required to understand the chemistry of how fragrance ingredients react with each other and the product they will be put into. (Remember, perfumers are not only creating perfumes, but fragrances that are used in skin lotions, nail polish removers, hair conditioners, and hundreds of other products.) An artistic flair is required to understand how different fragrance ingredients can invoke moods and feelings. As you can see, a master perfumer must be a good chemist and a good artist to get the job done properly.

The perfumer begins the process by building an accord which is the basic backbone of the fragrance that establishes its basic character Is it floral, fruity, or spicy?

A complex fragrance may contain multiple accords that are layered on top of one another. After the perfumer has created this basic version of the fragrance, an evaluator assesses it to see how well it meets the

requirements of the brief. In this stage, the fragrance is added to the actual product it is intended to be used in and smelled. The evaluator is looking at how well the fragrance meets the concept as well as initial compatibility with the base.

Based on the results of these evaluations, the fragrance may then go back to the perfumer for further tweaking. Several rounds of formulating and evaluation may be required before they are both satisfied with the fragrance as a viable candidate for the project.

Evaluating the Fragrance

Once the perfumer and evaluator agree that the fragrance is acceptable, it's ready to be put through a series of additional tests. The simplest tests are consumer panels that are used to ensure people perceive the fragrance the way the perfumer intended. Other tests are used to measure the strength of the fragrance or the way it blooms when the product is dispensed.

While a perfume is easy to evaluate by spraying onto skin or a paper blotter, it can be trickier to test fragrances designed for products that are diluted in water like shampoos and body washes. For this reason, the larger fragrance houses are equipped with sensory testing centers that allow them to evaluate products under a variety of conditions. For example, a shampoo fragrance can be tested in a chamber which simulates a bathroom shower. This way the fragrance can be smelled under "real life" conditions.

These test results are used to further optimize the fragrance. If the fragrance did not bloom well enough in the shower or if didn't last long enough on skin, the perfumers can return to the laboratory to make modifications. Once the fragrance has passed all these in-house evaluations, it's ready for the final test which is typically done with a larger number of panelists. It's typical to have up to 100 people smell the final fragrance to make sure it meets the requirements of the original fragrance brief.

Testing for Safety

Throughout the process, safety is a primary concern. Perfumers only use raw materials that have been pre-screened to ensure their safety. Ingredients that have serious health

concerns are banned from use. Others which have no serious issues but which have the potential to induce a mild allergic reaction in some people, are identified by name. Recent laws require the listing of these fragrance allergens on the ingredient statement for the final product. This is helpful to consumers that have allergies to fragrance components, because they can read the ingredient list and avoid products that contain that ingredient.

The Final Steps

This entire development process, from the time the brief is submitted to the time that a fragrance is complete, usually takes at least 2 months, depending on the nature of the project. At the end of the time, samples of the fragrance oil are sent to the client for evaluation. In last setion, we`ll look at how cosmetic formulators at the client company add the new fragrance to a product.

How the fragrance gets put into your product

You've already learned about how fragrances are created by Fragrance Houses and sent to cosmetic manufacturers. Now, it's time to learn about the issues chemists face when putting a fragrance into a finished product.

Adding Fragrance

Adding fragrance to a shampoo, body lotion, facial cleanser, or any other product, is not as easy as you might think. Chemists must first ensure that the fragrance can be properly mixed into the formula base. This may be tricky because fragrances are oily materials and may not be fully soluble in all types of formulas. If this is the case, additional chemicals called solubilizing agents can be added. (If you read the back of the bottle, a solubilizer typically looks like like "Polysorbate" followed by a number.)

Chemists must also make sure that the fragrance is added to the product at the right temperature or the scent might not smell right. Some products are heated during

manufacture because many cosmetic ingredients have to must be melted before they can be used. Since fragrances are very temperature sensitive, this can be a problem. To avoid damaging the fragrance, formulators add fragrance after they`re done heating the product.

Testing The Finished Product

Even after the fragrance is in the product, a lot can go wrong. For example, the ingredients in the formula can change the way the fragrance smells or the fragrance can cause the product to become cloudy or change color. So, once the chemist has properly incorporated the fragrance into the product, they use a process called stability testing to look for incompatibility between the fragrance and the formula. This process can take a month or more and involves testing samples that have been stored at elevated temperatures and exposed to UV light. These conditions accelerate the kinds of reactions that cause chemical changes.

During stability testing chemists look for any changes to the product. One of the most common types of change caused by a fragrance interaction is a change in viscosity. Some formulas will get thicker or thinner than they are supposed to be because of an interaction with a component of the fragrance. Fragrance can also affect a product's appearance. Fragrances have been known to turn a body wash from blue to green, or a conditioner from white to pink. They can also make a clear product, like a hair gel, turn cloudy or hazy. And fragrances can make creamy products, like hand lotions and suncreens, look grainy or even fall apart. Of course, the formulator also has to smell the product to make sure that the fragrance is not becoming distorted over time. That can happen because fragrances contain chemicals that are very reactive like ketones, aldehydes, esters, amides and alkynes.

Trouble Shooting

Depending on what goes wrong during stability testing, the chemist may attempt to fix the problem by adjusting the formula. For example, a shift in viscosity can be compensated for by adding a thickening or thinning agent. (Common table salt is widely used to thicken shampoo and body wash formulas.) If the problem is more serious, the

chemist may also ask the fragrance house to modify the fragrance oil to resolve the issue. To arrive at a final fragrance and formula combination, the chemist and fragrance house may have to experiment with several versions of the fragrance. After each fragrance revision, stability testing is repeated until the product is finally proven it`s ready to be sold.

All's Well That Ends Smell

As you have seen creating a fragrance and adding it to a cosmetic product is a complex process that requires both scientific and artistic skills. But thanks to the diligent efforts of the cosmetic chemists in the personal care industry, we're blessed with thousands of great hair and skin products that work great and are fun to smell!

How Aerosols Work

Every time you use a hairspray you're destroying the atmosphere and speeding up global warming, thus sending human civilization crashing toward extinction.

At least that's what some people would have you believe. In reality, hairsprays and other aerosols are safe and effective product forms used in thousands of beauty care products worldwide. This is the first installment in our four part series that explains what aerosols are and how they work. (And you can check out The Consumer Aerosol Products Council if you want the truth on aerosols, the ozone hole, and global warming.)

What is an aerosol?

Scientists define an aerosol as a "a self-contained, pressurized spray system designed to dispense various solid, liquid and gas products. This fancy definition really boils down to four basic elements that all aerosols have in common: The formula that the product delivers (e.g., a hairspray or a mousse); a container capable of withstanding high pressures; a propellant that forces the product out of the container; and a valve mechanism that seals the container and controls how the product is dispensed.

By adjusting the chemistry of the product/propellant mixture and by using different types of packaging, aerosols can dispense any thing from liquids, to foaming gels, to powders.

Types of aerosol products

In the context of beauty products, aerosols are used to dispense hairsprays, breath spray, mousses, deodorants, sun tan oils, shaving creams, contact lens sprays, dipilatories, and fragrances to name a few. They're also used for household products like air fresheners, paints, disinfectants, cook sprays, oven cleaners, insect repellants and hundreds of others. It's estimated that Americans use more than 1500 different kinds of aerosol products

at work and home. They range in size from the giant Sebastion Shaper hairspray size to the tiny purse tote size and everything in between.

History of aerosols

The first aerosols were pesticide sprays developed in the early 1940s to protect soldiers in War II from disease carrying insects. These early aerosol containers consisted of large steel tanks that had to be strapped on the soldiers' backs. (Compare that to the purse-size hairspray you have today!) After the war, the beauty industry realized that this pressurized spray technology could be used to deliver other products and the first aerosol hairspray was born. By the early 1950s, hairsprays, colognes and shaving creams were commonly sold in the U.S. Now, over 50 years later, aerosols are still a popular and effective delivery system with billions of units sold every year.

In the last half century, aerosols have had their ups and downs, however. In the 1970s, a common hair spray solvent, methylene chloride, was banned for health reasons. In the 1970s, CFCs, were banned in most aerosol applications because they were shown to contribute to the hole in the ozone layer. And in the 1990s, US air pollution regulations lead to restrictions on VOC's (Volatile Organic Compounds) in aerosol products.

Despite these setbacks, aerosols continue to be widely used in beauty products.

Over the course of this four part series we'll talk about the types of packaging used in aerosols (yes, they are recyclable!) as well as the ingredients used to make the products. We'll even tell you how these things are made.

Aerosol Packaging

As we discussed aerosols are a popular delivery system used in all kinds of household and beauty care products from Air fresheners to Zit creams. But did you realize that aerosols are different from ALL other beauty products because the package itself actually determines the product's physical properties? In this next part we explain the mechanics of aerosol packaging: the can that holds the product and the valve that controls how the product is dispensed.

Aerosol Cans

If you think about it, an aerosol product is kind of like a bomb. That's because it contains a pressurized, and potentially flammable, gas. So it`s important that the container is strong enough to withstand increases in pressure. Otherwise the hairspray you left in the back of your car in the middle of August would go Ka-boom! No worries though, because steel and aluminum are used to make aerosols cans extra sturdy. Let's take a look at each type.

Steel cans are easily recognized because they're assembled from 3 separate pieces. The body of the can is formed by rolling a sheet of metal into a cylinder. The top and bottom (known as the crown and the base) are formed from separate pieces. All three of these pieces are crimped together to form the can. If you can see the seam down the side of the can and the rim where the top and bottom pieces are attached, you know it's a steel can.

Aluminum cans, on the other hand, look smooth and sleek because they're formed by extruding a single slug of aluminum into the desired shape. Both cans are designed with a domed top and inverted bottom to help them invert or bulge if the pressure in the can increases. This allows the can to distort and increase in volume, so it can relieve pressure without bursting.

Steel cans are more commonly used because they're stronger, cheaper, and easier to process. But aluminum cans are more elegant looking and they are less reactive to water-

based products. And both can types are designed for recycling when empty.

Depending on the brand you buy, you can find products in either type of can. Regardless of the whether it`s made from steel or aluminum, the can is sealed with a piece of hardware called a valve.

Valves

Aerosol valves have to do double duty: they have to seal the opening of the can so it doesn't leak and they have to control how the product is dispensed. The way they accomplish these tasks is really a miracle of modern engineering.

Valves have three main sections: the part you are most familiar with is the button, or actuator that sits on top of the can. This is the part of the valve you push on to release the product. The button has a small opening though which the product comes out. In the case of a spray product, this orifice is very small and the product comes out as a very fine mist.

In the case of a mousse or shaving cream, the orifice is a larger spout and the product comes out as a thick foam. In either case, when you push the button it compresses a spring that opens up a small channel inside the body of the valve. Inside the valve body there are a series of small chambers where the product can mix with the propellant.

The bottom of the valve body is attached to a long, thin straw-like piece of plastic known as a diptube. The diptube extends to the bottom of the container and carries the product from the bottom up to the valve. (have you ever wondered why you have to turn some products upside down to get them to spray properly? That's because they don't have a diptube! You have to invert the package so the product inside can reach the valve body).

All these tiny parts are collected in a steel or aluminum housing, known as the valve cup, that is crimped over the opening of the can after it is filled with the formula and the propellant.

So, when it all comes together, the valve works like this: When the button is pushed, the gas inside the can pushes the formula up through the diptube into the valve body where it is broken up into tiny particles and finally forced out of the small opening on the face of the button. In other words, "Push button, stuff comes out." Seems simple, but it's really pretty amazing, huh?

The really astounding part is that these components have measured to a 1/1,000 of an inch or they won`t fit together and the valve won't function properly. Think about that the next time you're spritzing your hair.

Ok, now that you're properly in awe of the miracle of aerosol packaging, you're ready for a chemistry lesson on what's inside.

Aerosol Formulas and Propellants

In the first and second parts of this series, we waxed nostalgic about the history of aerosol products and explained how the packaging works. In Part 3, we talk about the stuff inside the can. There are two basic parts to an aerosol formula: the formula, which is a liquid concentrate, and the propellant which is a gas.

What's in the formula

The concentrate contains the goodies that makes the product function. If it's a hair styling product like a hairspray or mousse, the goodies are resins that hold your hair in place. If it's a breath freshener, the goodies are flavoring agents, and if it's a depilatory, the goodies are the active ingredients that dissolve your hair. The goodies will vary from product to product, but they give the product its basic functionality. They're the reason you buy the product in the first place.

In addition to the goodies, the concentrate contains other ingredients like, solvents, fragrance, pH adjusters, anti-corrosion agents, and a bunch of other chemicals that we won`t bore you with right now. All you really need to know is that the concentrate

is what makes the product do what's its supposed to.

What Is A Propellant

Propellant is a general term for any gas that propels the concentrate out of the can. There are several different types of gasses used as propellants, most of which are liquefied gasses. That means when the gas is under pressure it converts to a liquid. If you've ever seen a tank of propane gas used on a home BBQ grill, then you know what we're talking about. If you shake a tank of propane, you can feel it slosh around inside because it's a liquid. But if you open the valve on the tank: whoosh- the propane comes out as a gas. That's exactly how an aerosol works. Except in an aerosol the gas is mixed with the product concentrate (remember those goodies!) and the valve on the can is designed to release the product as a spray or a foam.

Four Types of Propellants

1) Propane represents one of the types of gasses used in certain kinds of aerosols. This type of propellant is known as a Hydrocarbon which is also referred to an LPG or Liquid Petroleum Gas. These gasses work very well in aerosols because they're soluble in alcohol and other solvents used in products like hairspray. However, they are very flammable and they have recently come under fire for contributing to air pollution. In fact, in the US, hydrocarbons are no longer used a primary propellants but they're still commonly used in other countries.

2) Chlorofluorocarbon (or CFCs) were popular propellants before hydrocarbons. These gasses have low flammability and good solvency, but they were banned from conventional aerosol use in the late 1970s because of fear they were damaging the ozone layer. Once this environmental problem was identified, the aerosol industry rushed to remvoe CFCs.
3) Hydrofluorocarbons (or HFCs) have many of the good properties of CFCs but they

don't affect the ozone layer. If you pick up an aerosol today you know it contains an HFC if it lists 1, 1-difluoroethane or Propellant 152a on the label. HFCs are particularly useful in hair sprays because they allow the creation of formulas without any water. (Water in a hair spray is a bad thing!) So hairsprays containing 152A are the best on the market. Unfortunately, while these propellants are almost technically perfect, they are very expensive so not many companies use them.

4) Dimethyl ether (or DME) is the only propellant that is miscible with water, which allows it to be used in lower cost formulations. While DME is an excellent propellant, adding water to a product like hairspray, can severely affect the way it works. Hairsprays become sticky, slow drying, and make your hair style droop. If you're shopping for an aerosol hairspray you should really avoid any product that lists water as an ingredient.

Ok, now that you know the fundamentals of aerosol packaging, formulas, and propellants, next we'll explain how they all come together to make a finished product.

Getting the Stuff into the Can

How do the liquid and the gas get inside the can? How is the can sealed so the gas doesn't just evaporate? And once it's all put together, how do we keep the whole thing from exploding? Now, we'll answer those questions as we explain how aerosols are made.

Aerosols require a special, highly automated manufacturing process. In fact, entire factories are built that specialize in making these products. These factories use long conveyor lines to move the products from station to station where different operations are performed.

Step 1: Preparing the Cans

At the start, the inside of the cans are cleaned with a blast of compressed air to get rid of any dust or dirt that might cause the valve to clog. A clogged valve = an aerosol that won't spray = a return trip to Walmart for you. So it's important that the cans

are clean before they travel to the next station where they're filled with liquid concentrate (the goodies in the formula that make it work).

Step 2: Filling

The liquid concentrate is blended in large stainless steel tanks and pumped to a filling station on the conveyor line. At this station, a filling nozzle injects a metered amount of the concentrate into the can. The exact proportions are critical: too much or too little liquid in the can will screw up the spray properties of the finished product. After the concentrate is squirted into the cans, they travel to another station that loosely inserts the valve assembly into the hole on top of the can.

Step 3: Gassing

The cans then travel to the next station where they get gassed. No, that doesn't mean they have too much to drink. It means the cans are charged with the propellant gas that makes them spray. As you can imagine, this is a very tricky process: the gas is under extreme pressure and evaporates in seconds. So this takes two steps that require split second timing.

First, a nozzle shoots a high pressure stream of gas around the valve cup, into the can. Second, a fraction of a second later, the valve cup is pushed down and locked into place. This process involves a device called a crimper that uses little metal fingers to push down onto the valve cup and spread it outwards. This force causes the metal cup to fit tightly against the opening of the can. If the pressure applied during this process is even slightly off, the can won't seal tightly. And a can that isn't sealed = a leaky can = a defective product = another return trip to Walmart for you.

This process is also called "under-the-cup-filling" because the propellant is filled before the valve cup is crimped on. There's another process known as "pressure filling," where the propellant is filled into the can through the valve stem opening after the valve is crimped into place.

Step 4: Testing

After they're gassed, the cans take a nice, hot bath. Literally. The conveyor belt runs the cans through a long trough filled with very hot water. As the cans pass through the water bath, people watch for escaping bubbles. Bubbles = gas is escaping = a defect in the can or valve = another trip...ah, never mind, you get the picture.

Step 5: Final Packaging

After their trip to the spa, the cans are dried off by jets of air sort of like those dryers in restrooms except you don't get to wipe your hands on your pants. Finally, the cans pass through a capping station that places the over cap on top of the package. Then they're packed into boxes and palletized for shipping.

Whew! That's much more complicated than just filling a bottle of shampoo! And much more dangerous too. The entire process must be done under special ventilation to avoid buildup of explosive propellant. So there you have it. Now you should have a pretty good appreciation of how hairsprays and other beauty care aerosols are made.

What now?

Well, there you have it. The end of the first Beauty Brains Guide to How Beauty Products Work.

And as we said earlier, if you like what you've read here, go check out theThe Beauty Brains blog. Better yet, if you have a burning beauty question that you think could be answered by real cosmetic chemists, go to the blog and Ask the Brains! There's a handy little button for just such a request.

Feel free to pass this along to your friends and family. It is our goal to make everyone a smarter beauty product customer.

Still not enough of the Beauty Brains? Go check out this page which tells you all about the new Beauty Brains book! In it, we answer over 100 questions that we've been asked about beauty producs. Go get it. You won't be unhappy.

Thanks for reading.