

What is PEG?



Polyethylene glycol, or PEG, is an organic compound made up of carbon, hydrogen, and oxygen. PEG has been scientifically demonstrated to be safe for human consumption and is used frequently for pharmaceutical purposes. PEG's characteristics vary greatly depending on its molecular weight, which can range from 300 to 10 million. With all these variations, PEG has a number of different uses in a wide variety of common household items. Just how common? PEG is on the FDA's "Generally Regarded as Safe" classification list and can be found in toothpaste, skin cream, soft-gel pill capsules, chewing gum, sports drinks, and pharmaceutical inhalers, just to name a few.

In the cannabis industry, PEG is often used as a carrier liquid for THC in vaporizer cartridges. At certain molecular weights, PEG has the perfect viscosity to thin extracted THC and make the concentrate in your cartridge turn into vapor more quickly and efficiently. That is to say, PEG improves the function of concentrate in a vaporizer.

PEG is also used to standardize consistency. Refined CO₂ oil can vary dramatically in THC potency, anywhere from 40 to 90 percent or more depending on input material, extraction methodology, refining methodology, and other factors. Adding PEG allows manufacturers to dilute the raw extract to a standard, reliable potency.

PEG has been the focus of a large number of toxicity studies (including the National Academy of Sciences, and U.S. National Library of Medicine) as a result of its wide range of uses in products designed for consumption. There have been well over 40 different studies conducted over the last 70 years looking at the effects of PEG exposure on animals and humans. These studies have found that at normal doses, PEG has no toxic effects when inhaled or ingested. For example, rats who were exposed to concentrated PEG200 vapor for six hours did not have any adverse or visible effects



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compared to a control group (Crook *et al.* 1980). In another study, dogs were given a diet that included 2% concentrations of PEG400, PEG1540, and PEG4000, and the animals experienced no adverse effects (Smyth *et al.* 1955).

If PEG is so commonly used and proven to be non-toxic, why is there such wide discussion about its safety?

One of the sources for the confusion is that PEG is often confused with ethylene glycol (EG), a chemical compound used in antifreeze, hydraulic brake fluids, and in the manufacture of polyester fibers. EG is toxic in large doses. The confusion

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is understandable given the similar sounding names, but EG is an entirely different compound, with a different molecular structure and different characteristics, from the non-toxic PEG that you will find in our concentrate.

How does PEG compare to other carrier liquids and cannabis consumption methods?

There are a number of different ways to consume cannabis, from vaporization to combustion. Even within the broad category of vaporization, there are several ways to make concentrate. A variety of carrier compounds can be used in vaporizer cartridge liquids, as well. Let's take a look at how PEG stacks up against these other common carrier compounds, as well as how it compares to the chemicals released through combustion:

Propylene Glycol (PG)

Due to similarities in spelling and abbreviation, consumers often confuse PEG with another entirely different compound called propylene glycol (PG). PG is commonly used in household items like liquid sweeteners, ice cream, and pharmaceutical inhalers. Although PG is generally considered safe, we believe that there is more evidence to support the safety of PEG, and have therefore elected to use it in our products.



“All of these studies have, by and large, found that at normal doses, PEG has no toxic effects when inhaled or ingested.”

Vegetable Glycerin (VG)

Vegetable glycerin is clear, odorless, and produced from plant oils—most commonly, palm or coconut oil. VG is one of the three most common carrier liquids used in vaporizer cartridges, along with PG and PEG. VG is known to be non-toxic in animals and humans. VG has a slightly higher density than PG and PEG, which can lead to build-up on the heating element of vaporizers after extended use. VG also has a slightly sweet taste, which can mask the flavors of the concentrate more than PG or PEG does. Although there is no specific data indicating a risk associated with VG, there is also virtually no evidence supporting its safety for inhalation. As a result, Alchemy does not use VG as a carrier liquid.

Recently, there has been a concern that VG (and other carrier liquids) might cause lipid pneumonia in heavy users. VG—along with PEG and PG—cannot cause lipid pneumonia, because they are not lipids, or fats. VG is an alcohol-based compound. The only scenario in which a vaporizer could cause lipid pneumonia is one in which lipid (oil) based flavoring is used in the cartridge. Alchemy products do not use lipid-based flavoring.

Combustion Smoking

According to a US National Library of Medicine National Institute of Health study, “inhalation of a combustible product is an undesirable delivery system.” Vaporizing is a superior delivery system, and many doctors agree and mention this approach when prescribing medical recommendations. A 2007 study by Dr. Mitch Earleywine posits that “vaporizers heat cannabis to release active cannabinoids, but remain cool enough to avoid the smoke and toxins associated with combustion.”

We've looked at how all of the various carrier liquids in vaporizer cartridges compare, but how does vaporizing as a whole compare with combustion smoking? If you are looking for the more healthful method of cannabis consumption, there is no contest—vaporizing is better for you than combustion smoking, no matter what carrier liquid is in your cartridge. Cannabinoids—the source of THC—begin vaporizing at temperatures as low as 285° F, and most vaporizers operate at an optimal temperature of 338°. The temperature at which the cannabis plant actually combusts, however, is much higher than that, at around 392°. Whereas vaporizing only breaks down the cannabinoids to release THC, combustion breaks down the rest of the plant material to release a num-

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ber of different chemicals, including 12 known carcinogens, such as benzopyrene and benzanthracene.

What is Prop 65, and what does it have to do with PEG?

In California, Prop 65, the Safe Drinking Water and Toxic Enforcement Act of 1986, requires that the state maintain a list of chemicals known “to cause cancer or reproductive toxicity.” Anyone that sells a product containing one or more of the chemicals on the list needs to display clear signage—on the product and at the point of sale—that it contains chemicals known to cause cancer, birth defects, or reproductive harm.

The goal of this legislation has always been to help people make the right choices for their health. In reality, however, this long list of chemicals can cause confusion, especially when certain chemicals make the list while others that are similar in name or composition do not. Neither PEG nor PG is on the most up-to-date Prop 65 list (in fact, both are on the FDA’s “Generally Regarded As Safe” classification list); however, propylene glycol mono-t-butyl ether—yet another molecule with a similar name but very different structure from both PEG and PG—is on the list as a carcinogen (“Chemicals Known to the State to Cause Cancer or Reproductive Toxicity,” State of California Environmental Protection Agency). Propylene glycol mono-t-butyl ether is a solvent used in all-purpose cleaners, lacquers, and nail polish—it is not designated for consumption of any kind.

Since June, 2009, however, cannabis smoke has been included on California’s Proposition 65 list. Earlier this year, several dispensaries throughout the state were served 60-day notices for not complying with Prop 65 regulations—that is, not displaying a clear warning that they carried merchandise that produced a known carcinogen on the list. This notice was not targeted at vaporizer products but rather combustible cannabis. Dispensaries in California do not need to display a Prop 65 notice for their vape products, but they do need to display a notice for their combustible cannabis products.

Conclusion

PEG is a thoroughly researched, widely used, non-toxic chemical that we encounter every day in household items, including pharmaceuticals and food products. PEG remains our top choice for consumer usage given PEG’s strongly documented merits and the fact that it is used in these products that have wide distribution. The confusion around PEG, PG and other chemicals has led some people to believe that



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PEG and PG are unsafe options for concentrate production and consumption; however, this is not the case. As a carrier liquid in vaporizer cartridges, PEG research has shown it is harmless and effective. Compared to the other carrier liquids currently on the market, PEG has the most scientific evidence behind it to support its safety and categorization as a pharmaceutical grade product.

At Dark Heart we use PEG400 in our Alchemy line of vaporizer pens. Why? After thorough research, we determined that this carrier liquid is the safest for human consumption. Using PEG400 helps us deliver a consistent, moderate THC dosage with our products. Combining PEG with Alchemy’s proprietary herbal extract blends guarantees that customers enjoy a consistent, healthy experience time and time again. At Dark Heart, we believe in a science-first approach, and always refer to published peer-reviewed studies in assessing the relative safety of a product.

Alchemy is a product like no other vaporizer pen on the market. We have researched and combined methodologies from several different healing traditions to create a vape pen uniquely capable of helping patients achieve their desired state of being. Whether a patient wants to Relax, Awaken, be Inspired, or Explore, Alchemy can help get them there.

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