

E-cigarettes

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Definition

E-cigarettes, more formally known as electronic cigarettes, are personal electronic devices that heat a nicotine solution with a battery-powered electric coil called an atomizer. When the solution is heated, a vapor resembling smoke is released that the user can inhale it as if he or she were smoking a cigarette. E-cigarettes are also called e-cigs, personal vaporizers (PVs), and electronic nicotine delivery systems (ENDS). Variants of e-cigarettes include e-hookahs, hookah pens, and e-cigars. The use of any variation of an e-cigarette is called vaping.



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Description

Since their introduction to the worldwide market in 2004, e-cigarettes have undergone considerable evolution. Early models were designed to resemble conventional cigarettes or cigars; they are called cig-a-likes. Some are designed to look like ballpoint pens and are popularly known as pen-styles. Another type of e-cigarettes in use as of 2017 are advanced mods, called mods for short. Mods can be found in all shapes and sizes with a common element being a large removable and rechargeable battery and removable coil cover.

Most e-cigarettes contain the following components:

The mouthpiece: also known as the cartridge, the mouthpiece contains a heating coil that vaporizes the e-liquid when the user sucks on the mouthpiece. Other names for the larger cartridges in newer e-cigarettes are cartomizer or tank.

The atomizer. The atomizer is the heating device (usually an electric coil) that vaporizes the e-liquid. It requires replacement every 3–6 months.

The battery: The battery is the power source of an e-cigarette. It is the largest component of most e-cigarettes and takes up most of the space inside the external cylinder. Most new models of e-cigarettes contain rechargeable lithium-ion batteries. Early e-cigarettes had a switch that turned the battery on and off, while an LED at the other end of the e-cigarette glowed when the user inhaled. Newer e-cigarette batteries contain airflow sensors that activate the battery when the user inhales through the mouthpiece. Advanced mods may allow for variable power output or a wide variety of battery and atomizer configurations. The most common type of battery is a lithium battery, which increases battery life, but may overheat, explode, and cause burn injuries.

The e-liquid: The e-liquid, also called juice, usually, but not always, contains nicotine. In most cases it is a mixture of propylene glycol (which is the source of the vapor that appears when the e-cigarette is used); vegetable glycerine; and flavorings. The cartridge can either be replaced or refilled by the user when the liquid is gone. E-liquid is also sold in bottles or in kits that allow users to make their own juice and modify or intensify its flavor.

Origins

Some observers trace the origin of e-cigarettes to the mid-1960s, when a so-called smokeless non-tobacco cigarette was patented. After 1965, some inventors experimented with a charcoal-based vaporizer used to heat a nicotine solution, but the devices were clumsy as well as expensive to use. The invention of cell phones eventually led to the development of contemporary e-cigarettes. The need to shrink the size of cell phones and invent longer-lasting batteries to power them made it possible to fit a battery and electric coil, along with a cartridge containing a nicotine solution, inside a cylinder the size and shape of a standard tobacco cigarette.

The invention of the first e-cigarette is usually credited to Hon Lik, a Chinese pharmacist, who first sold the device as a smoking cessation aid in 2004. From China, e-cigarettes were exported to Vietnam, where they were discovered by a Belgian entrepreneur, J. Andries Verleur. Verleur had Chinese manufacturers improve the design of Hon Lik's original product. He then formed a company and began selling e-cigarettes worldwide in 2009.

At first, e-cigarettes were slow to find acceptance, but by 2017 there were at least 500 brands on the market in the United States, up from 288 in 2012. Some of these brands were manufactured by traditional tobacco companies, but most were imported from developing countries. In addition, more than 7,700 different e-liquid flavor combinations and nicotine strengths were available. The annual market for e-cigarettes in the United States in 2016 was estimated at \$3.7 billion.

Demographics

The American Lung Association estimated that in 2015, 3.7% of American adults used e-cigarettes, but that 59% of e-cigarette users also continued to smoke tobacco. Thirty percent of adult e-cigarette smokers were former tobacco smokers, and 11% had not smoked before starting to use e-cigarettes. In the United Kingdom, 4% of adults or about 2.2 million people, smoked e-cigarettes in 2016.

E-cigarettes are much more popular with teens than with adults. Use among high school students rose from 1.5% to 16.0% between 2011 and 2015. In 2016, the National Institute on Drug Abuse estimated that 3.6% of eighth graders, 6.3% of tenth graders, and 11.4% of twelfth graders used tobacco

cigarettes. This compares to 9.5%, 14.0%, and 16.2% of e-cigarette users in those grades. Twice as many high school boys buy e-cigarettes that do girls. E-cigarettes also appear to be a gateway to smoking tobacco. Among high school e-cigarette users, 30.7% began smoking tobacco products within 6 months of starting on e-cigarettes, while only 8.1% of those who did not use e-cigarettes took began smoking tobacco in the same period.

Purpose

The purpose of an e-cigarette is to deliver a pleasurable vapor by inhalation. The vapor usually, although not always, contains nicotine and may contain fruity or candy-like flavorings. The dose of nicotine varies considerably from manufacturer to manufacture. A very few e-cigarettes are nicotine-free; these deliver only chemically flavored vapor. Some new advanced mod e-cigarettes allow a procedure called dripping. In dripping, the cover is removed from the heating coil, and e-liquid is dripped with an eyedropper directly on to the coil. This superheats the liquid and creates a bigger vapor cloud and a greater nicotine hit.

Risks

The perception, especially among teens, is that smoking e-cigarettes are safer than smoking tobacco. Although it is true that e-cigarettes do not expose others to second-hand smoke, research shows that e-cigarettes present health risks. Risks associated with e-cigarettes can be summarized as follows:

The social risk of undoing 50 years of successful antismoking campaigns and health regulations, increasing the total number of people addicted to nicotine worldwide. Nicotine stimulates the production of epinephrine (adrenaline) by the adrenal glands and the release of dopamine, a neurotransmitter, that stimulates the reward center of the brain. This reward or pleasurable response makes nicotine addictive.

Increasing the popularity of nicotine-based products among teenagers, particularly by the creation of sweet or candy-like e-cigarette flavors that are attractive to youngsters has caused researchers suggests that e-cigarettes will be a gateway into using tobacco products for young people.

The vapor from e-cigarettes poses some health risks. The vapor contains heavy metals such as lead, some by-products of nicotine, and ultrafine particles. The long-term health effects of inhaling these by- products are unknown. The amount of toxic chemicals is increased when e-liquid is superheated by dripping.

The risks of long-term inhalation of propylene glycol (PEG), the organic molecule that appears as visible vapor when an e-cigarette is used is not known. Although PEG is considered safe for use in foods and is used in theatrical performances to create fog or mist onstage, no one knows whether years of inhaling it in an e-cigarette is safe.

Quality control issues exist with regard to the flavorings used in e-liquids. Some cartridges have been found to be contaminated, and there are no industry standards for the flavorings used; some ingredients may be potentially toxic. In addition, some flavoring agents may be carcinogenic.

A significant increase in the number of child poisonings involving e-cigarette e-liquid refills containing nicotine has been reported to the CDC. Nicotine is poisonous in even small amounts, and can cause vomiting, seizures, and death. The CDC reported that calls to poison control centers concerning poisoning from e-cigarette cartridges rose from an average of one per month in 2010 to 215 per month by early 2014. Children or adults can take in nicotine from e-liquids in one of three ways: inhalation, swallowing, or absorption through the skin or eyes. Especially in young children, even low doses of nicotine can be fatal. Intentional suicide by ingesting e-liquid has been attempted and in some cases, completed.

There is no standardized amount of nicotine in e-liquid, so there is no way of for users to know how much nicotine each puff contains or the total amount of nicotine they are

receiving.

The lithium batteries that heat the coil of an e-cigarette can overcharge, become overheated, and explode. Severe burns have required emergency room visits, and permanent scarring may result.

Regulation

In August 2014, the World Health Organization released a report on ENDS urging member countries to 1) restrict the use of e-cigarettes indoors; 2) ban candy-like, fruit-based, or alcoholic beverage-based flavors; and 3) limit sales to persons over the age of 18. Most researchers note, however, that any such worldwide restrictions will take years to implement.

In March 2016, the use or charging of e-cigarettes was banned on any airplanes flying to, from, or within the United States. E-cigarettes could not be packed in checked luggage because of concern about battery explosion but could be transported in carry-on luggage, although they could not be used aboard.

Beginning in February 2017, vapes, vaporizers, vape pens, hookah pens, electronic cigarettes, and e-pipes collectively called electronic nicotine delivery systems (ENDS) became regulated in the United States by the Food and Drug Administration (FDA). The regulations consider ENDS as tobacco products. This means must meet the same labeling standards as tobacco products and must carry a health warning notification. Retailers can sell only to individuals old enough to purchase tobacco products. This age restriction, however, is often circumvented by internet sales. Manufacturers and importers of ENDS must also file certain paperwork with the FDA and meet new record-keeping requirements. In addition, facilities that manufacture or mix e-liquids are also regulated, sometimes as both a manufacturer and a retailer.

Currently, there is little uniformity worldwide regarding restrictions on e-cigarettes. Some countries, including Singapore and the United Arab Emirates, ban all e-cigarettes as illegal, while some European countries ban only those containing nicotine, and others restrict only the indoor use of e-cigarettes. Some countries do not consider e-cigarettes to be equivalent to tobacco products and impose few or no restrictions on their sale, manufacture, importation, or use.

Research and general acceptance

Initially e-cigarettes were promoted as a method of stopping tobacco smoking. One of the major controversies about e-cigarettes has been whether they achieve this purpose. As of 2017, medical researchers remain somewhat divided as to whether e-cigarettes are useful in weaning users from conventional tobacco products, with most of reputable research showing that they are not a satisfactory smoking-cessation tool. Nicotine remains undeniably addictive no matter whether it is delivered by vaping or smoking tobacco. Research shows that many teenagers as well as adults who have never smoked tobacco are using e-cigarettes, and some, especially teens, are moving on to smoking tobacco. As of 2017, no company has applied to the FDA to license any ENDS device as a smoking cessation product.

As more research is done on e-cigarettes, it is becoming clear that potentially serious health effects may exist. One study found that some e-cigarette smokers developed mouth and lip sores that are slow to heal. The cause appears to be damage to cells called fibroblasts that produce proteins that pull the edges of wounds together. As of 2017, researchers are looking at whether the same phenomenon occurs in the lungs of vapers. Other researchers have found that people who vape are more likely to have symptoms of asthma.

The social dimension of smoking is cause for concern among health researchers who study e-cigarettes. It has been known for years that one of the reasons that smoking is a difficult habit to break is the ritual behaviors associated with it. The ritual of lighting up, sharing cigarettes with others, and

smoking as part of a convivial get-together can help ease the way into social situations. Smoking was also associated with glamor and sophistication through the 1970s, when it became increasingly stigmatized as a cause not only of lung disease in smokers but also a danger to nonsmokers through secondhand smoke.

Some researchers fear that the increasing use of high-end e-cigarettes, particularly the expensive customized models, will reverse the stigma presently associated with smoking and make the habit socially acceptable or even glamorous again. This concern is based partly on the fact that the vapor of an e-cigarette is much less noticeable (thus much less annoying) to others nearby than the smoke of a conventional cigarette or cigar and partly on the emergence of a distinct subculture based on vaping. Some members of the vaping community are attracted to the lifestyle of vaping, others consider it a hobby, while most are attracted to the perception that e-cigarettes can be safer alternative to tobacco smoking.

Key Terms

Adrenal gland

An endocrine gland located above each kidney. The inner part of each gland secretes epinephrine (adrenaline) and the outer part secretes steroid hormones. These hormones to help regulate blood pressure, blood sugar levels, and metabolism.

Atomizer

The battery-powered electric coil inside an e-cigarette that vaporizes the e-liquid. It contains a wick that draws in the e-liquid for vaporization.

Dopamine

A neurochemical made in the brain that is involved in many brain activities, including movement and emotion.

E-liquid

The solution contained in an e-cigarette that is vaporized when the device is used. Also called juice, it typically contains propylene glycol, vegetable glycerine, flavorings of various types, and (in most cases) nicotine.

Fibroblast

A type of cell found in connective tissue that manufactures proteins that encourage wound healing.

Neurotransmitter

One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

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Organizations

National Institute on Drug Abuse Street 6001 Executive Boulevard, Room 5213 Bethesda MD 20892-9561 Phone (301) 443-1124 information@nida.nih.gov <https://drugabuse.gov/nidahome.html>

United States Centers for Disease Control and Prevention (CDC) Street 1600 Clifton Road Atlanta GA 30329-4027 Phone (404) 639-3534 Free (800) CDC-INFO (800-232-4636); TTY: (888) 232-6348 <http://www.cdc.gov>

United States Food and Drug Administration (FDA) Street 10903 New Hampshire Avenue Silver Spring MD 20993-0002 Free (888) INFO-FDA (463-6332) <http://www.fda.gov>

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