How a Vape Pen Works: Electronic Nicotine (or Cannabis) Delivery Systems

A vape pen has a power source that heats up a tank or cartridge that holds e-cigarette liquid which is inhaled by the user when taking a breath. The user then exhales as a normal function of breathing and produces a cloud of aerosolized e-cigarette liquid. Vape pens are battery-powered devices that are pocket-sized, easily concealed devices[1].

Vape pens are either rechargeable or disposable. A rechargeable vape pen is a battery-powered device used for vaping with a variety of atomizers and cartridges that can be refilled and recharged after use[2]. A disposable vape pen is an all-in-one unit comprised of an internal battery, a pre-filled tank and a coil. They are neither rechargeable or refillable, and are disposed of when depleted. Disposable vape pens have become the most common types in schools because they are not regulated under the Food and Drug Administration (FDA) rules for vape pens[3].

Vape pens are also either draw activated or push button. Draw-activated vape pens are activated when the user inhales from them so there are no buttons to push and no on/off switch. They are the easiest type of vape pens to use. Push-button vape pens need to be turned on before use. This is typically done by pressing the power button multiple times to activate it.

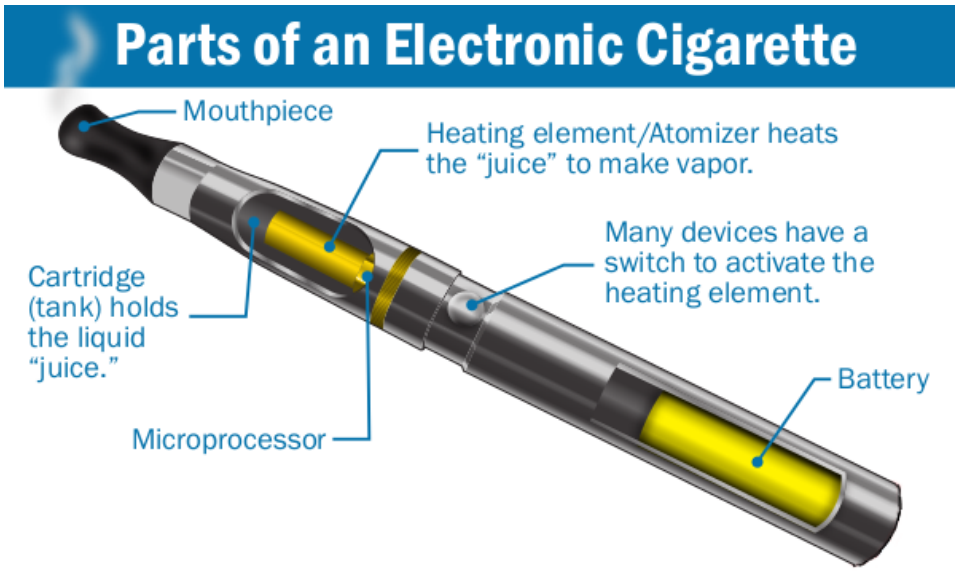

Figure 1: Anatomy of an electronic cigarette[4]

What Vaping Produces in the Air: Aerosolized Liquids and Heavy Metals

Vape pens produce aerosolized e-cigarette liquid; not true gaseous vapor. Aerosolized liquid is essentially very small droplets or particles of liquid suspended in air[5]. The aerosol particle sizes range from 0.0001 to 10 µm and can be serious irritants resulting in symptoms like headaches, fatigue, trouble concentrating, and irritation of the eyes, nose, throat and lungs[6]. The Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS) for aerosolized particles with a size of 2.5µm is set at 35 µg/m^3 as acceptable exposure level[7]. However, during vaping events particle counts can increase by 10x to 100x the EPA NAAQS guidelines.

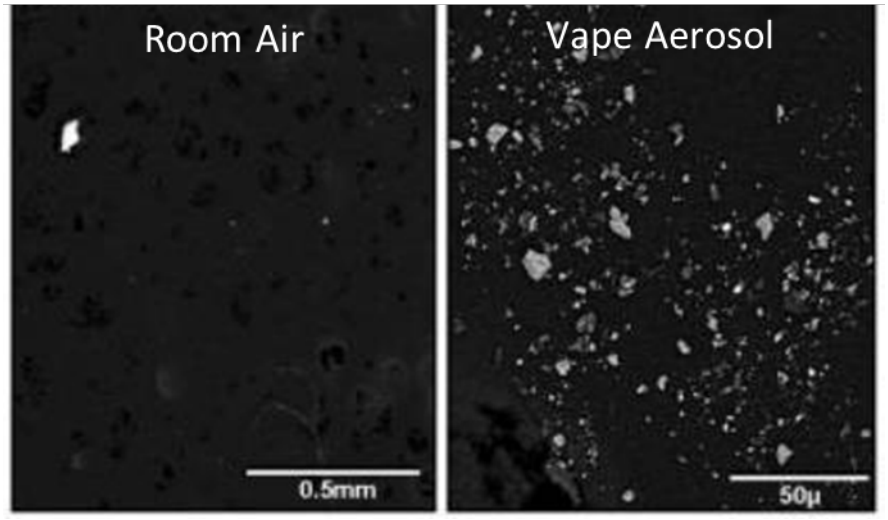

Figure 2: Comparison of particulate in room air (left) and particulate in room air after vaping (right)[8].

In addition to the aerosolized liquid generated when vape liquid is heated, there are numerous hazardous chemicals produced that can be linked to multiple diseases. For example, acrolein is just one chemical identified in vape aerosol but it is linked to 87 different disease pathways[9]. Vape chemicals have been linked to diseases affecting the lungs, teeth, and mental health, thus far. Although research is still continuing on the health effects of chemicals that result from vaping.

Finally, heavy metals, which are considered carcinogens, were identified in e-cigarette aerosol in several studies. Levels of lead, chromium, and nickel in e-cigarette aerosol were equivalent to, and in some cases higher, than what has been reported for cigarette smoke. The primary source of the trace metals was linked to the aerosolizing components inside the e-cigarette[10].

Endnotes

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