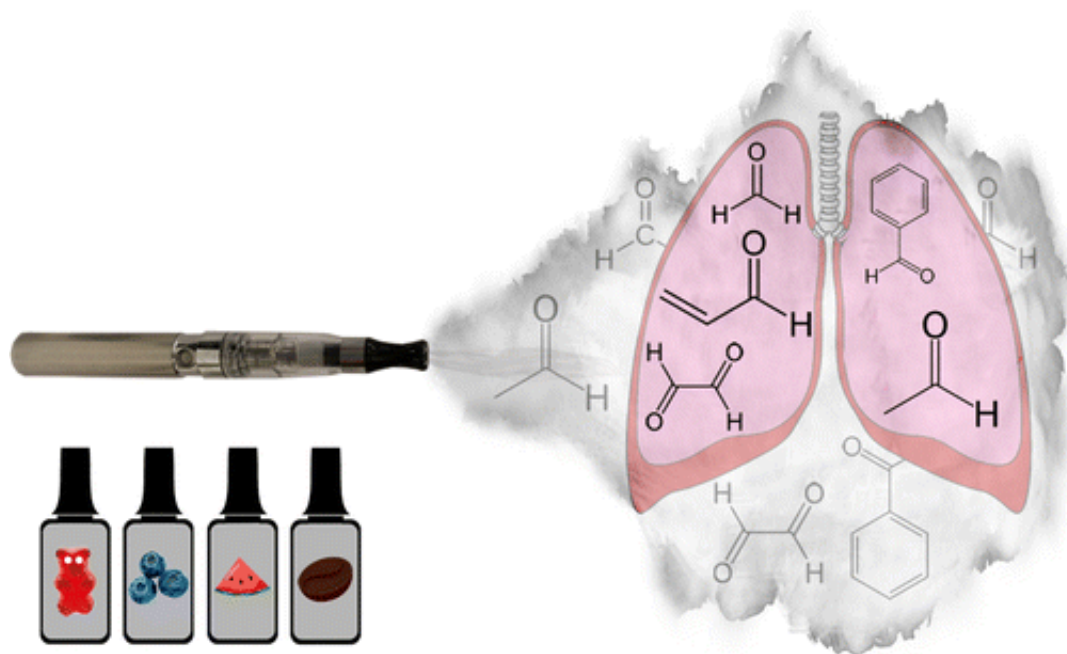


# Vapors from some flavored e-liquids contain high levels of aldehydes

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Credit: American Chemical Society

Traditional cigarettes pose a well-established risk to smokers' health, but the effects of electronic cigarettes are still being determined. Helping to flesh out this picture, researchers are reporting in the ACS journal *Environmental Science & Technology* what happens to e-liquid flavorings when they're heated inside e-cigarettes or electronic nicotine-delivery systems. The study found that when converted into a vapor, some flavorings break down into toxic compounds at levels that exceed

occupational safety standards.

Since [electronic cigarettes](#) were first introduced to the market in 2003, health officials have been tracking usage and studying potential health effects. A 2015 survey by the National Center for Health Statistics reported that 3.7 percent of adults used the devices regularly, and 12.6 percent had tried them at least once. Some studies have identified the ingredients in e-liquid flavorings, but very little research has been done to determine what happens to them when they are transformed inside the device. A growing body of research on e-cigs has shown that the heat that converts e-liquids into vapor decomposes its contents, producing aldehydes and other [toxic compounds](#) that can potentially cause [health](#) problems. Andrey Khlystov and colleagues wanted to investigate the specific role that [flavorings](#) play in these reactions.

The researchers analyzed vapors created from both unflavored and flavored e-liquids loaded into three popular types of e-cigarettes. The tests for 12 different aldehydes showed that the amount of potentially harmful compounds varied widely across e-liquid brands and flavors. However, the study also showed that in general, one puff of flavored vapor contained levels of aldehydes exceeding the safe thresholds for occupational exposure—set by the American Conference of Governmental Industrial Hygienists—by factors of 1.5 to 270. Vapors from unflavored e-liquids contained aldehydes at significantly lower levels.

**More information:** Andrey Khlystov et al. Flavoring Compounds Dominate Toxic Aldehyde Production during E-Cigarette Vaping, *Environmental Science & Technology* (2016). [DOI: 10.1021/acs.est.6b05145](#)

## Abstract

The growing popularity of electronic cigarettes (e-cigarettes) raises

concerns about the possibility of adverse health effects to primary users and people exposed to e-cigarette vapors. E-Cigarettes offer a very wide variety of flavors, which is one of the main factors that attract new, especially young, users. How flavoring compounds in e-cigarette liquids affect the chemical composition and toxicity of e-cigarette vapors is practically unknown. Although e-cigarettes are marketed as safer alternatives to traditional cigarettes, several studies have demonstrated formation of toxic aldehydes in e-cigarette vapors during vaping. So far, aldehyde formation has been attributed to thermal decomposition of the main components of e-cigarette e-liquids (propylene glycol and glycerol), while the role of flavoring compounds has been ignored. In this study, we have measured several toxic aldehydes produced by three popular brands of e-cigarettes with flavored and unflavored e-liquids. We show that, within the tested e-cigarette brands, thermal decomposition of flavoring compounds dominates formation of aldehydes during vaping, producing levels that exceed occupational safety standards. Production of aldehydes was found to be exponentially dependent on concentration of flavoring compounds. These findings stress the need for a further, thorough investigation of the effect of flavoring compounds on the toxicity of e-cigarettes.

Provided by American Chemical Society

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