

Putting electronic cigarettes to the test

Fraunhofer



Are e-cigarettes harmful to users? An unresolved question. It's harder still to judge the danger to bystanders. How many different substances do e-smokers exhale - and what are they? A new study brings light to the shadows.

Electronic cigarettes are experiencing somewhat of a boom at the moment. An estimated two million people in Germany have already turned to the vapor cigarette, which many view as a healthy alternative to conventional smoking. However, a number of voices, primarily from the political sphere, are warning of possible health risks, claiming that the long-term consequences cannot yet be foreseen. Studies to date have come to mixed conclusions. There is a general lack of substantiated facts, fuelling an ongoing battle between supporters and opponents. By carrying out a new, independent study, researchers at the Fraunhofer Institute for Wood Research WKI in Braunschweig hope to introduce a degree of objectivity into this emotional topic of debate. The scientists' goal was to

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Published on Electronic Component News (<http://www.ecnmag.com>)

find out whether e-cigarettes pollute the surrounding air, thus affecting bystanders of an e-cigarette user.

An e-cigarette consists of a battery, an atomizer, a heating coil and a reservoir for the liquids used for producing vapor. These liquids are heated up in the atomizer and vaporized at between 65 and 120 degrees Celsius. The user activates the mechanism either by pressing a button or by suction, depending on the design. Liquids come with or without nicotine, and also contain aromas and flavors like amaretto, almond, vanilla or apple. Propylene glycol is the most usual solvent; it produces the atomized mist that resembles smoke when exhaling. In contrast to conventional cigarettes, which constantly emit smoke as the tobacco burns, the electronic equivalent only releases volatile substances when it is turned on. But that is not the only difference between the two stimulants, as the WKI researchers observed. "In the e-cigarette, vaporized substances create an aerosol of ultrafine particles which become even finer when inhaled into the lungs. These tiny nanodroplets disperse over time. In contrast, the combustion process discharges solid particles that can remain in the surrounding air for a considerable time", says Dr. Tobias Schripp, scientist at Fraunhofer WKI and co-author of the study.

No formaldehyde emissions detected

The Fraunhofer experts conducted a series of test chamber measurements to analyze emissions of volatile organic compounds (VOCs), ultrafine particles and formaldehyde, with particular emphasis on the quantity, concentration and distribution of particles. Tests were conducted using volunteers in an 8-cubic-meter test chamber, where conventional cigarettes were compared with e-cigarettes containing a variety of liquids. To ascertain how the distribution of particles develops over a number of minutes, and the amount of propylene glycol released in the longer term, the vapor was in addition pumped directly into a 10-liter glass chamber. This test was performed on different types of e-cigarette, all containing the same liquid. "In general, the emissions of VOCs and ultrafine particles when smoking an e-cigarette were lower than the equivalent emissions from a standard cigarette", says Schripp. Furthermore, the researcher and his team were not able to detect any formaldehyde emissions from the e-cigarette. Conventional cigarettes, on the other hand, exceeded the guideline value of 0.1 ppm (parts per million) for indoor air quality under the given test conditions. Vaporized propylene glycol was released into the air from both electronic and tobacco cigarettes, as it is also often used as an additive in tobacco. Pulmonologists fear that this solubilizing agent can irritate the airways when inhaled in large quantities. "While it is true that the electronic cigarette contributes less to indoor air pollution than tobacco cigarettes, it is not entirely emission-free. Consequently, it seems reasonable to assume that bystanders are exposed to the released vapor and thus 'passive vaping' is possible", says Schripp, summing up the results of his measurements. He also criticizes the product labeling strategy, which in many cases provides inexact or inadequate information on the liquids used. As a result, e-smokers often have no reliable way of knowing what potentially harmful substances they are inhaling and exhaling.

The scientists' aim in carrying out this study is to provide measurement data suitable for use as the basis for future investigations. "However, the study does not

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claim to provide any kind of toxicological assessment”, stresses Schripp. A summary of the results was published in the Indoor Air journal (<http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0668.2012.00792.x/pdf> [1]). The researchers intend to present the study on December 6, 2012 at the 10th German Conference for Tobacco Control.

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