Vaping chemical creates toxic ketene gas, research finds

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A chemical found in some vaping products can produce a highly toxic gas when heated up, according to new research from RCSI University of Medicine and Health Sciences.

Led by researchers at RCSI's Department of Chemistry, the study is published in the current edition of *PNAS*.

In August 2019, the US Centers for Disease Control and Prevention reported an increasing number of lung injuries following the use of some vaping products, and vitamin E acetate was identified as one possible cause. Though some patient lung biopsies showed signs of chemical burns that vitamin E acetate alone would not be expected to cause.

Vitamin E acetate, primarily found in illegally made THC-based vape liquids, is considered non-toxic in vitamin supplements and skin creams. This new research has now shown that heating up vitamin E acetate through vaping can produce ketene, a highly toxic gas.

Ketene is a colourless gas with a penetrating odour. When inhaled, it can cause serious damage to the lungs up to 24 hours after exposure. It is lethal at high concentrations, and at lower concentrations, it can irritate the eyes and lungs and impair the central nervous system.

The researchers connected a vaping device to a series of glass vessels, which allowed them to collect samples after simulating a person vaping vitamin E acetate from the device.

In addition to chemically trapping the toxic ketene gas, the researchers also found that heating up vitamin E acetate produces other carcinogens that are found in regular tobacco smoke.

"It should be noted, however, that these experiments were designed to determine the vaping effect on a single pure substance at the chemistry molecular level. Determining the exact relevance of these results to the direct cause of lung injury requires further studies due to the diversity in vaping devices, mixtures and their modes of use," said the study's lead author and RCSI Professor of Chemistry Donal O'Shea.

While vitamin E acetate is typically found in illicit street-bought vapes, the researchers warned against the potential dangers of the ever growing number of chemicals found in vaping products.

"The high temperatures created in vaping devices can lead to unforeseen chemical reactions. Therefore, other components of vape mixtures, including flavours and additives, also require investigation as they too may produce toxic and carcinogenic substances when heated," said Professor O'Shea.

More information: Dan Wu et al. Potential for release of pulmonary toxic ketene from vaping pyrolysis of vitamin E acetate, *Proceedings of the National Academy of Sciences* (2020). DOI: 10.1073/pnas.1920925117

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