

# Researchers identify more than 100 toxic chemicals in cannabis smoke

June 25 2020, by Michael Brown

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University of Alberta engineering researchers have characterized the potentially hazardous particles in cannabis smoke and have raised awareness about their potential health effects.

"It's not out of line to say there's potential health risk in marijuana

smoke, and there's not nearly enough research," said Robert Nishida, a U of A post-doctoral fellow and co-lead on the study.

Among the billions of particles found in a single puff of cannabis smoke, Nishida's team observed 2,575 [chemical compounds](#) and was able to identify 536. Of those, 110 are known to be toxic, whether they be carcinogenic, mutagenic or teratogenic, which are chemicals that can interfere with the development of the embryo or fetus.

And while they found more [toxic chemicals](#) in tobacco (173), Nishida's team found the particles in [cannabis smoke](#) were about 29 percent larger. In all, researchers found 3.4 times more mass from the total particulate matter in a typical cannabis joint than a cigarette.

"And with some caveats, that mass is what you consider tar," said Nishida.

Tar is a term used to describe the tacky brown substance made up of toxic chemical particles left behind by burning tobacco.

## **Smoking machine**

Nishida and his team, whose expertise is in developing instrumentation for measuring aerosol particles, employed a "[smoking](#) machine," which acts like a lung to draw the desired volume of smoke from samples of both a standard tobacco and a cannabis cigarette.

He said tobacco cigarettes were chosen as the benchmark because they have been studied for decades.

"We compared all of our measurements against a standard reference cigarette. We picked what we think is the most standard or typical type of marijuana joint."

The smoke goes into a large bag where the lab's aerosol instrumentation measures the properties of the particles, which were also catalogued according to their [physical characteristics](#), such as size and concentration, as well as some [chemical properties](#).

Nishida explained the size of particles determines where in the lungs they, and the chemicals they're composed of, get deposited.

"Whether it's in the throat, or the upper airways, or if it gets transported all the way down into the alveoli, that depends on the size of the particles and their other physical characteristics," he explained.

Nishida suggested a full understanding of tobacco smoke and its health effects is probably not complete, yet the public has been warned of their hazards.

"It's not out of line to say there's potential health effects of marijuana smoke," he said. "Tobacco cigarettes have been studied for decades, and even with [tobacco](#) I don't think the picture is fully there. The body of research for marijuana smoke is not even remotely comparable."

He said researchers need to better understand [marijuana smoke](#) including different puff profiles, joint design, cannabis strains and how the chemicals are delivered to more fully understand their [health effects](#).

The study, "Comprehensive Characterization of Mainstream Marijuana and Tobacco Smoke," was published in *Scientific Reports*.

**More information:** Brian M. Graves et al. Comprehensive characterization of mainstream marijuana and tobacco smoke, *Scientific Reports* (2020). [DOI: 10.1038/s41598-020-63120-6](https://doi.org/10.1038/s41598-020-63120-6)

Provided by University of Alberta

Citation: Researchers identify more than 100 toxic chemicals in cannabis smoke (2020, June 25)  
retrieved 19 April 2024 from

<https://medicalxpress.com/news/2020-06-toxic-chemicals-cannabis.html>

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