Scientists seek marijuana's isotopic fingerprint

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Scientists at the Alaska Stable Isotope Facility can tell whether marijuana confiscated in a traffic stop in Fairbanks likely came from Mexico or the Matanuska Valley. They're also working on a way to determine whether it was grown indoors or out.

A few more years and enough samples and they hope to have something even more precise: an elemental fingerprint that could tell police where and under what conditions a sample of marijuana was grown.

"There are scientists already doing this for drugs like heroin and cocaine," said Matthew Wooller, Alaska Stable Isotope Facility director. "The potential is there for being able to do this for marijuana as well."

The key lies at the atomic level. Of particular interest to Wooller and his colleagues are the stable isotopes of four elements: carbon, oxygen, nitrogen and hydrogen.

Isotopes are atoms of elements that have the same number of protons and electrons but different numbers of neutrons. A stable isotope is one that doesn't decay over time. Those additional or missing neutrons in an isotope slightly alter the mass of the atom, allowing scientists to use a stable isotope ratio mass spectrometer to separate the light isotopes from the heavy ones and form a ratio for each sample. That ratio can tell scientists about the sample and its origins.

"The marijuana holds a signature of the environment that it used to be

grown in," Wooller said. "It is laid down in time and preserved in the materials that make up a plant."

For example, oxygen and hydrogen ratios can reveal information about the water a plant used while growing and, as a result, where it was grown. Water in Alaska and other high latitudes generally has a larger proportion of light oxygen and hydrogen stable isotopes than water from locations at lower latitudes.

Carbon tells another story, he said. It can offer information on whether a plant was grown outdoors or inside. Nitrogen could provide even more information.

The testing at the UAF facility is novel because, for each sample, scientists are taking the isotopic signatures of four elements, rather than for just a single one, Wooller said. "We have the potential to create a precise chemical fingerprint."

The marijuana research began approximately two years ago and was initially supported by a grant from the University of Alaska President's Special Projects Fund. The UAF Police Department provided the lab samples of marijuana confiscated locally.
"We started off running samples of unknown origin," Wooller said, noting that even those samples yielded some surprising results.

Scientists initially assumed that most of the samples would show that they had been grown in Alaska rather than being imported from the low latitudes.
"In fact, what we saw is there are samples that are almost certainly grown in high latitude," he said. "Then you had marijuana that was clearly grown at lower latitudes."

Since then, the project has expanded beyond samples of unknown origin.

The federal Drug Enforcement Administration and the Alaska Bureau of Alcohol and Drug Enforcement have started providing samples from grows in Alaska.

Wooller hopes that, with enough of those samples, he can create a marijuana isotope map for Alaska and beyond, which could eventually allow scientists to match unknown samples with known growing locations.

The project has potential to help police on multiple levels, according to Investigator Stephen Goetz at the UAF Police Department.

From an evidentiary standpoint, it could tie a growing operation to marijuana seized on the street, he said, and offer evidence of both the production of marijuana and its distribution.

"The common denominator that people use as their defense is that (they) are growing it for their personal use only," Goetz said. If marijuana seized from a dealer, for example, matched that growing operation, it could counter such a defense, he said.

It could also help the state's drug enforcement officials track the trafficking patterns of marijuana by comparing where the marijuana was grown to where it is seized, Goetz said. "It could, theoretically, focus law enforcement's efforts on where to look for (growing operations.)"

In order to get the method to that level, though, Wooller said he needs time, money and many more samples of marijuana, either from known locations or that are grown in a laboratory, such as the state crime lab, under controlled conditions.

"We need more data," Wooller said. "We need more analyses of marijuana samples from known locations so we can create these base

marijuana isotope maps."

Source: University of Alaska Fairbanks