Physicists develop a method of detecting counterfeit whiskey using spectroscopy

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Image: Wikipedia

(PhysOrg.com) -- Physicists Praveen Ashok, Bavishna Praveen, and K. Dholakia working together at the University of St Andrews in Scotland have developed a method for testing whiskey for authenticity using a crafted device that allows for measurements via spectroscopy. The results of their research have been published in the journal *Optics Express*.

While it has long been known that spectroscopy could be used to analyze the components of whiskey, or any liquid that allows light to pass though it for that matter, previous models have required a lengthy setup process by a technically savvy person. This new process, in contrast, can be

conducted by virtually anyone at any location once the device is sold commercially.

The device is actually nothing more than a microfluidic chip made of polydimethylsiloxane (PDMS), a type of clear plastic that has had horizontal channels carved into it to allow the insertion of fiber cables and vertical channels for the input and output of tiny whiskey samples. The reason it has been set up this way is to prevent evaporation of alcohol while the sample is being tested.

Once set up the apparatus looks like a flat piece of clear plastic about a quarter inch thick with four channels in it, all leading to its center. The channel or hole on top is where the whisky goes in. One channel leads to one side that is connected to a suction device for pulling the whisky through the channels. Two other channels leading to two other edges respectively are for holding fiber optic cables. One going in, the other out to the spectrometer.

To run the device, a drop of whiskey is dropped into the hole on top. It is then shot with a laser via the fiber optic cable and then read by spectrometer on the other end of the output fiber cable. The whiskey output channel is used for pulling the whisky back out so that the channels can be cleaned and the device reused.

The spectrometer performs two types of analysis. The first is to test for alcohol content. For whisky to be considered authentic it must be at least 40% alcohol.

The second analysis measures other organic compounds found in the whiskey samples, such as esters and aldehydes, which are collectively called congeners. Also in the whiskey are tiny bits of wood from the casks that held the whiskey as it matured. The combination of all these substances, despite the fact that they amount to less than 1% of the

volume of whiskey, are what make each unique, both visually, and in taste. By comparing the amounts of each in the sample, the spectrometer is able to indentify whether it is authentic, as well as its brand, age and in some cases, which cask it came from.

More information: Near infrared spectroscopic analysis of single malt Scotch whisky on an optofluidic chip, *Optics Express*, Vol. 19, Issue 23, pp. 22982-22992 (2011) dx.doi.org/10.1364/OE.19.022982

Abstract

Standardization and quality monitoring of alcoholic beverages is an important issue in the liquor production industry. Various spectroscopic techniques have proved useful for tackling this problem. An ideal sensing device for alcoholic beverages should be able to detect the quality of alcohol with a small amount of sample at a low acquisition time using a portable and easy to use device. We propose the use of near infra-red spectroscopy on an optofluidic chip for quality monitoring of single malt Scotch whisky. This is chip upon which we have previously realized waveguide confined Raman spectroscopy. Analysis on this alignment-free, portable chip may be performed in only 2 seconds with a sample volume of only 20 μl. Using a partial least square (PLS) calibration, we demonstrate that the alcohol content in the beverage may be predicted to within a 1% prediction error. Principal component analysis (PCA) was employed for successful classification of whiskies based upon their age, type and cask. The prospect of implementing an optofluidic analogue of a conventional fiber based spectroscopic probe allows a rapid analysis of alcoholic beverages with dramatically reduced sample volumes.

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