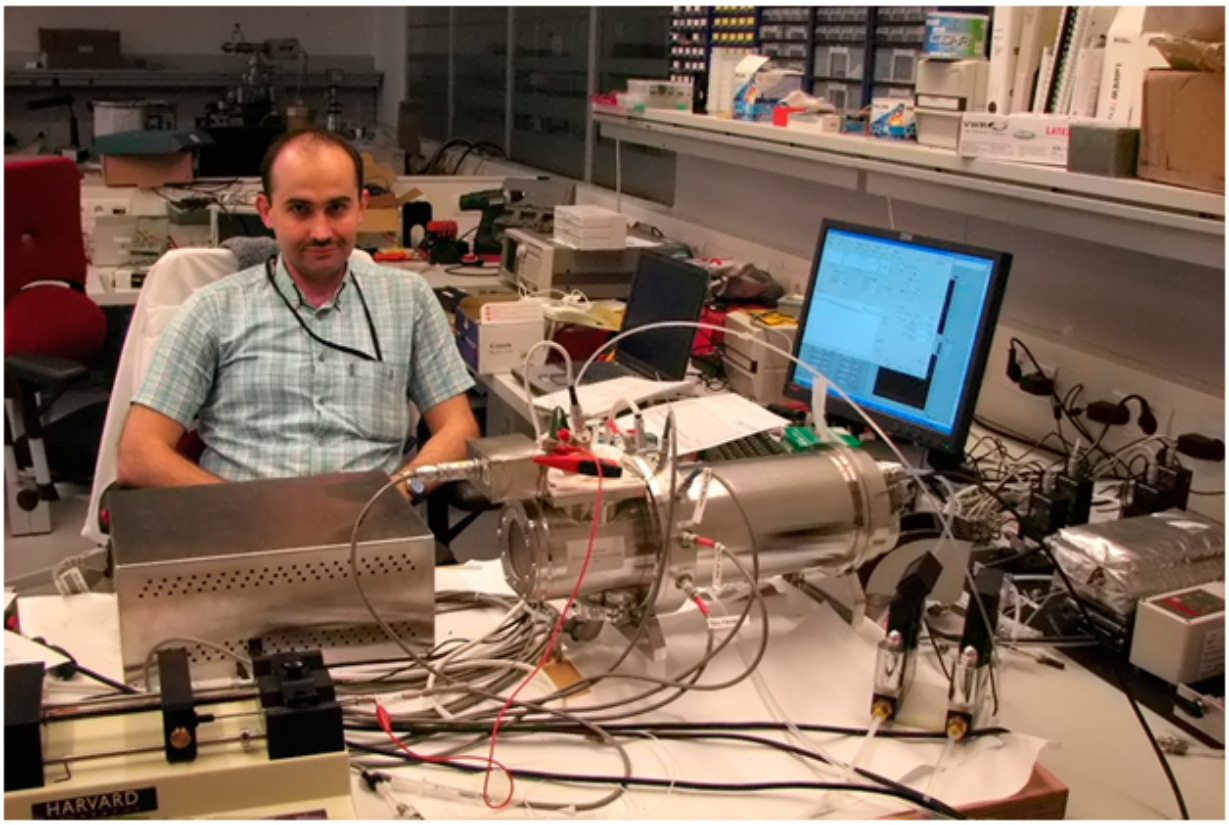
Hybrid spectrometers to define the contents of complex multi-component samples

August 5 2016



One of the device's developers, Associate Professor Alexey Sysoev. Credit: National Research Nuclear University

Devices created by MEPhI scientists based on the principles of drift ion mobility spectrometry and mass spectrometry allow the quick analysis of

the contents of complex multicomponent samples, which has multiple applications in pharmaceuticals, criminal forensics, safety, medicine and monitoring of environmental objects.

The growing need for such rapid mass spectrometers has prompted the creation of import-substitution domestic developments. Scientific and technical solutions offered by employees of the Department of Molecular Physics have unique analytical characteristics, including quickness and accuracy of information acquisition.

One of the main advantages of a new hybrid device using time-of-flight spectrometry and ion mobility spectrometry is the high selectivity and speed of analysis (three to 100 sec.) of multi-component samples. The detection limit in the liquid is one molecule for 5 billion molecules of the basis. High selectivity is achieved by a consecutive division of probe components by two characteristics: the size of ionized molecules in ion mobility spectrometres and mass ratio to charge. Such two-dimensional division allows the analysis of certain very complex multi-component samples.

The devices are based on the principles of drift ion mobility spectrometry and mass spectrometry. "Traditional methods of detection of multi-component sample contents combine liquid or gas chromatography and mass spectrometry, which allow for long duration of measurement over dozens of minutes. In the case of ion mobility spectrometry—time-of-flight mass-spectrometry—the duration of measurement can be diminished 10 to 100 times," says Associate Professor Alexey Sysoev. "This is crucial for a number of applications. In particular, under the development of new medicines, the analysis of a vast number of samples is required at the stage of synthesis, and in the field of safety, the efficiency of the analysis allows the increase of the number of inspections with high level of selectivity."

Another important feature of the drift ion mobility spectrometers is a higher resolving power that reaches 100. Apart from the possibility of separation on the mobility of a large number of probe components, it raises the precision of defining the modified mobility of compounds, which is important for their further identification.

Currently, MEPhI scientists are raising the selectivity and sensitivity of devices and methods, which will increase possible applications in the spheres of life sciences and oil analysis. The scientists hope to achieve the inclusion of an ion mobility high-resolution spectrometer into the hybrid device in partnership with Wichita State University in the U.S., thereby increasing resolving power.

"Further increasing of resolving power will be crucial for detection of various conformations and post-translational modifications of biological molecules connected with the development of incurable diseases," said Professor Alexander Shwartsburg of Wichita State University. "Movement in this direction will allow us to explain destructive phenomena in human metabolism."

Provided by National Research Nuclear University

Citation: Hybrid spectrometers to define the contents of complex multi-component samples (2016, August 5) retrieved 28 April 2024 from https://phys.org/news/2016-08-hybrid-spectrometers-contents-complex-multi-component.html