AGILENT CASE STUDY: EMPOWERING RESEARCHERS

SIMPLER, FASTER, MORE ACCURATE
RESEARCHER USES AGILENT INSTRUMENTS TO CREATE MORE EFFECTIVE ANALYTICAL METHODS

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At Wake Forest, a private, independent research university in North Carolina, George Donati has been finding ways to increase the speed and accuracy of the analytical process.

Two of his new methods resolve an issue that often vexes chemists.

"To determine analyte concentrations, you need to compare your results with a known value," Dr. Donati explains.

To ensure accuracy, analytical chemists may need to prepare a series of five or six standard solutions with increasing concentrations—a laborious process—in order to create a calibration curve. The curve helps them determine how much of their analyte of interest is contained in their sample.

But there's a catch. The traditional calibration curve assumes that the analyte in their sample is in the same chemical environment as the known standards.

"However, that is rarely the case," Donati says. "Sometimes the difference is so great that when you compare the two, the result is just wrong."

Donati's new methods—Standard Dilution Analysis and Multi-Energy Calibration—are both less time consuming and more accurate.

"By combining the plasma stability of Agilent's 4200 MP-AES and our new methods, we were able to develop dilute-and-shot procedures that take only a few minutes to run and provide reliable results even for complex samples such as coffee, biodiesel, and cough medicine," Donati says.

"The new methods can significantly reduce the analysis time and improve precision and accuracy for any analytical technique capable of simultaneous multi-analyte determinations using liquid samples."

Both methods can be implemented in routine applications with virtually no instrument modification.

Here's how the first method works:

"Basically, you introduce a solution into the instrument that has half sample and half standard. Then you mix in the same tube another solution that has half sample and half blank (water for example)," Donati explains. "When you mix that, the sample amount is always the same, but then the standard will be diluted. Now, if you collect data continuously, in the first second you have the initial concentration. One second after that, it's a little diluted because that solution is mixing. Two seconds later, a little more diluted.

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So as you do that, the concentration (and consequently the instrumental response) changes. By the changing concentration and by knowing how much you had in the beginning, you can have a calibration curve with many, many points. The same thing you would have preparing different flasks, you can have inside a tube by the solution mixing with the blank."

The second method is similar, but involves another dimension: wavelength.

"The traditional way to do things: you have a fixed wavelength and you change the analyte concentrations to establish a relationship with some instrumental response (emission intensity, for example). With Multi-Energy Calibration, you would have a fixed concentration and vary the wavelengths," Donati says. "You would run a solution that has half sample and half standard, and then another solution that has half sample, half blank. Then you compare the instrumental responses from those solutions against each other in different wavelengths. Using the slope of that relationship and a little math, you can calculate the analyte concentration in your sample. The more wavelengths you monitor the more precise and accurate your measurement is."

As in the first method, the environment around the analytes doesn't change from solution to solution, so accuracy can be significantly improved.

In another project, Donati and his team will use the high sensitivity of Agilent's 8800 Triple Quadrupole ICP-MS to analyze fingernail and toenail samples to identify mineral imbalances associated with some important diseases.

"Because of this instrument's outstanding ability to minimize some severe interferences, we will be able to develop very sensitive procedures and potentially identify patients at the early stages of chronic diseases such as diabetes and osteoporosis," he says. "The 8800 Triple Quadrupole ICP-MS will allow us to determine trace levels of several essential elements, which may not be possible with less sensitive methods."

What inspired the project?

"My grandma had diabetes," Donati says. "In fact she passed away a long time ago due to complications related to that disease, so I knew a little about that. The nails of diabetics don't look the same as those of healthy individuals. Since I work with atomic spectrometry, I thought, 'That might have some relationship with the nail mineral constitution.' When I talked to doctors who work with this disease every day, they told me, 'Oh, yeah, there's something there. Perhaps we can collect some samples and find out.'"

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