Agilent Case Study: Ghent University

Studying the Efficacy of Chemotherapy Drugs By Measuring Isotope Ratios

Combining chromatography and ICP-MS techniques to measure extremely low levels of elements for medical science research projects.

Dr. Kaj Sullivan, postdoctoral researcher at the Atomic and Mass Spectrometry (A&MS) Research Unit of Ghent University, recently spoke to Agilent about his research.

Q. Tell us about your research

At A&MS, I'm working on a project related to ovarian cancer. We are studying the link between trace element dysregulation for elements such as copper, iron, zinc, calcium, magnesium, and potassium, and the resistance to platinum-based chemotherapy drugs.

We measure ultra-trace levels of elements and do isotopic analysis to try and understand the processes that are involved in resistance to those drugs.

Q. What challenges does your work have?

One of the most challenging parts of our work is the very low concentrations of the metals that we are trying to measure. We need to prevent contamination from the surrounding environment impacting our measurements. This includes the reagents, the ion exchange resins we use to isolate each element, and all the equipment we use. We work in a clean room laboratory that has very, very low levels of particles floating around in the room. Any contamination of our samples will throw off the results. Preparing a sample for isotopic analysis is a very lengthy process.

Q. Can you describe your sample preparation process?

Firstly, we must collect the sample. We need to make sure that we're not introducing contamination at that point. We're primarily working with blood samples, but blood collection tubes contain additives. We need to be conscious of what kind of tubes we're using, because these additives can introduce elemental contamination.

Agilent

Trusted Answers

Once we have a sample, we then need to digest it. We must ensure that the digestion vessels and the acids are pure and clean with very, very low contamination. Finally, we must isolate each element that we're interested in for isotopic analysis.

Due to the way we measure isotope ratios, polyatomic interferences can impact the measurement. We must have only a single element in the sample to prevent those interferences.

We use chromatography to isolate each element, which can take from 2 to 10 hours, depending on the element. There's a lot of potential for contamination in this step. We see recurring patterns of contamination. Recovering 100% of each element in a purified fraction is also tricky.

Q. What do you look for in the instrumentation you use for these measurements?

We're looking for instruments that have very high sensitivity to measure the very low concentrations we have. When measuring certain elements like potassium, which has lots of interferences, we use an ICP-MS collision cell to eliminate the interferences.

Q. How did you get started with this research?

I began my journey in geology. During the fourth year of my studies, I took a course in isotope geochemistry with my late PhD supervisor, Kurt Kyser. This exposed me to all these different topics and research such as that being done here in Ghent.

I started reading studies on biomedical problems that isotopic analysis can potentially help with. These studies included investigating the role or certain elements in breast cancer and chronic kidney disease. I became interested in using the knowledge I'd gained as a geochemist and applying it to biomedicine.

Once I learnt about the potential, I was hooked on trying to come up with novel research ideas and I did my PhD in this area. After my PhD, I reached out to Professor Frank Vanhaecke, here at Ghent University about working with him. We came up with a project and the rest is history.

Q. What keeps you interested in this research?

I'm really excited to be here because I've only been in a geology department previously. It's lonely if you're a geologist interested in diagnostic and prognostic markers of diseases.

Here, I'm surrounded by six other individuals who are really interested in applying isotopic analysis this way. It's very exciting to be here with so many different projects in this area. I'm learning a lot; different chromatographic techniques and new isotope systematics.

I like to help people and I like the fact that what I'm doing can be applied in medicine. It's still an emerging field, but I can see a future where what I'm doing can help, and that keeps me motivated.

www.agilent.com/chem/

RA44789.6262615741

Published in the USA, February 15, 2023
5994-5234EN

Agilent
Trusted Answers