



Environmental analysis

TSQ 9610 GC-MS/MS delivers increased sample throughput in an analytical laboratory

“The performance of the TSQ 9610 GC-MS/MS has exceeded our expectations, and we are very happy to have the equipment in our laboratory.”

—Kjell Hope, Pacific Rim Laboratories

Analytical testing laboratories that analyze environmental and food samples are under pressure to produce consistent data at low levels of detection for compounds in a variety of matrices. Pacific Rim Laboratories in Canada faces these challenges every day. Pacific Rim is an analytical testing laboratory that analyzes a wide range of environmental and food samples for trace level contaminants.¹ Kjell Hope, a technical research chemist at Pacific Rim explained, “We look at samples in matrixes that include soil, air (emission/ambient), water, sediment, tissue, and food. We analyze a wide range of contaminants including dioxins, organochlorine pesticides (OCP), polyaromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), polybrominated diphenyl ethers (PBDEs) and tributyltin (TBT). Here at Pacific Rim, we typically process between 8,000 to 10,000 samples per year.”

First and foremost, Pacific Rim Laboratories must deliver accurate results that adhere to the regulations followed by their clients. Hope gave more detail on this, “Ninety percent of our methods are based on U.S. EPA methods for compliance. Since we investigate new compounds, some may not have official U.S. EPA or EU regulations attached, and we base those methods on ISO 17025 best practices.²”



Thermo Scientific™ TSQ™ 9000 GC-MS/MS system

In some cases, Pacific Rim is asked to meet detection levels beyond what is specified in the regulations. Traditionally the laboratory has used magnetic sector technology to achieve this lower detection capability, but when the laboratory met testing capacity with their instrumentation, they investigated other instrumentation. When considering a new investment, the priority for the laboratory was to obtain an instrument with consistent low-level sensitivity to exceed the regulatory demands of their customers.

Pacific Rim added the Thermo Scientific™ TSQ™ 9000 GC-MS/MS system and later the Thermo Scientific™ TSQ™ 9610 GC-MS/MS system to their instrument inventory. This allowed them to increase the sample throughput of the laboratory. While the laboratory still runs their magnetic sectors systems for key methods, they have moved some of their analysis onto the TSQ 9610 GC-MS/MS and have been impressed with the sensitivity and the robustness of the system. Hope elaborated on this, “We knew adding another system to the laboratory would increase our sample capacity.

However, we saw increased throughput due to the robustness of the instrument and its ability to handle dirty matrices such as soil, industrial smokestack samples, and wastewater. This ensures we do not have to re-clean and re-run samples, which saves us time. This enabled us to increase our throughput for the analysis of alkylated PAHs, nonylphenols, chlorophenolics, and certain PBDEs and marker PCBs, by between 50 and 100%.”

“We put the TSQ 9610 GC-MS/MS through ruggedness testing and it met method validation requirements as listed in ISO 17025.”

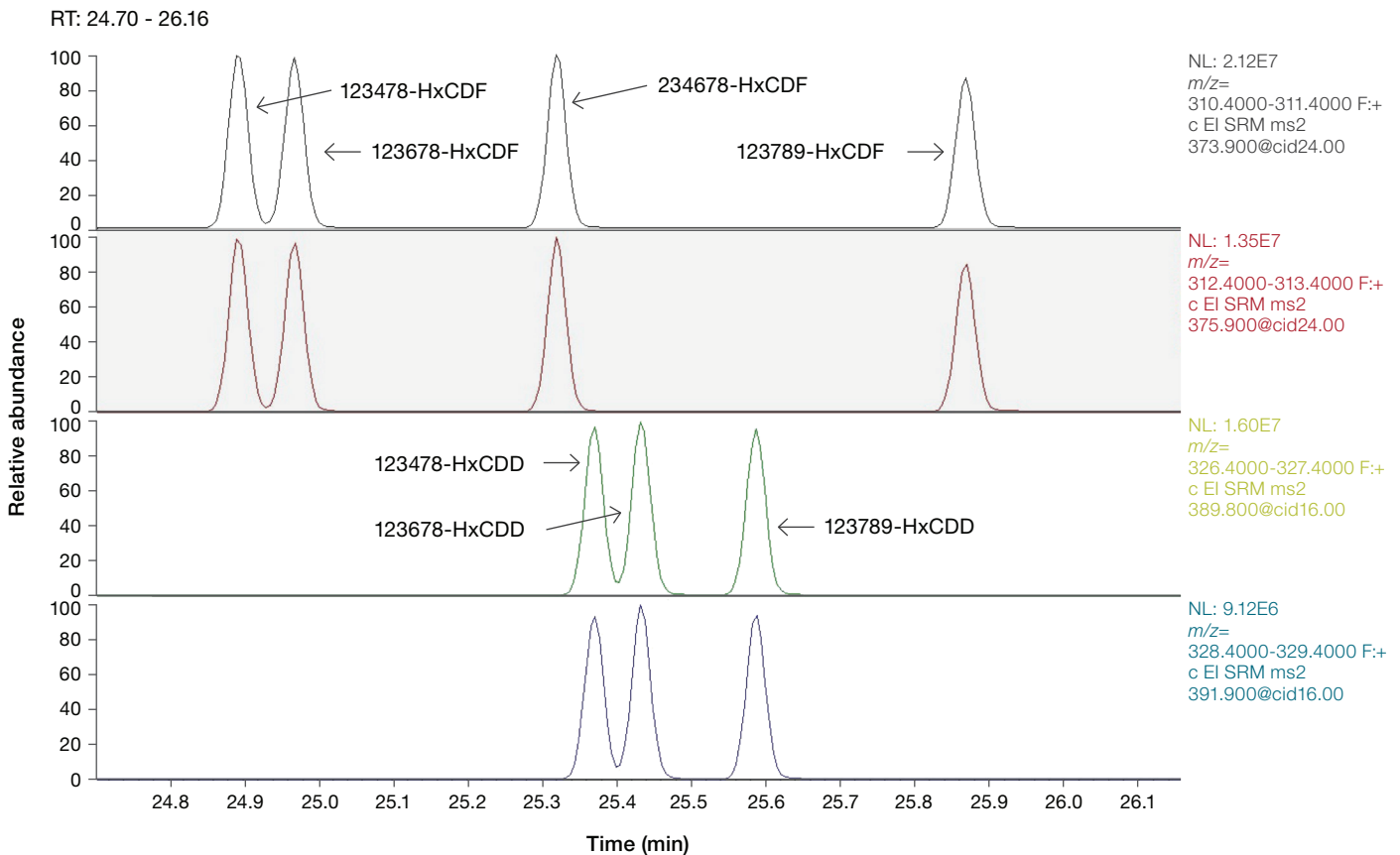


Figure 1. Critical pair separation of the hexa dioxins and furans using the TSQ 9000 GC-MS/MS

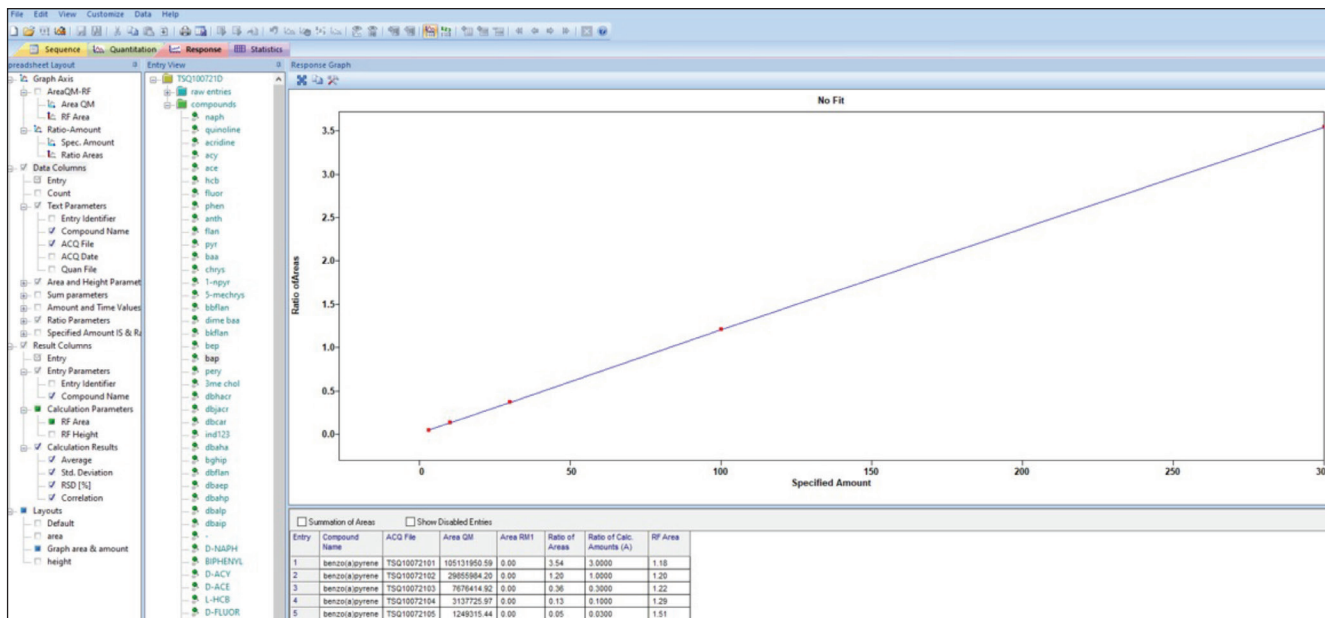


Figure 2. Analysis of PAHs on the TSQ 9610 GC-MS/MS, showing a calibration curve for benzo(a)pyrene from 3 to 300 $\mu\text{g}/\mu\text{L}$

Implementing the TSQ 9610 GC-MS/MS has reduced some of the challenges faced by the laboratory. Hope elaborated, “One of the key challenges faced by the laboratory is to deliver sensitive and stable results to meet the regulatory requirements. By adding the TSQ 9610 GC-MS/MS to our workforce, this challenge has become less of an issue as the system delivers consistent results at low levels of detection.” The instrument has permitted

them method consolidation that would traditionally be separate at Pacific Rim, which has even further increased the sample throughput of the laboratory. Hope remarked, “The TSQ 9610 GC-MS/MS enables us to create methods that could detect multiple different analyte types in a single injection (marker PCBs, BDE, and OCP). This allows us to reduce the number of injections per sample and thus get the results to our clients quicker.”

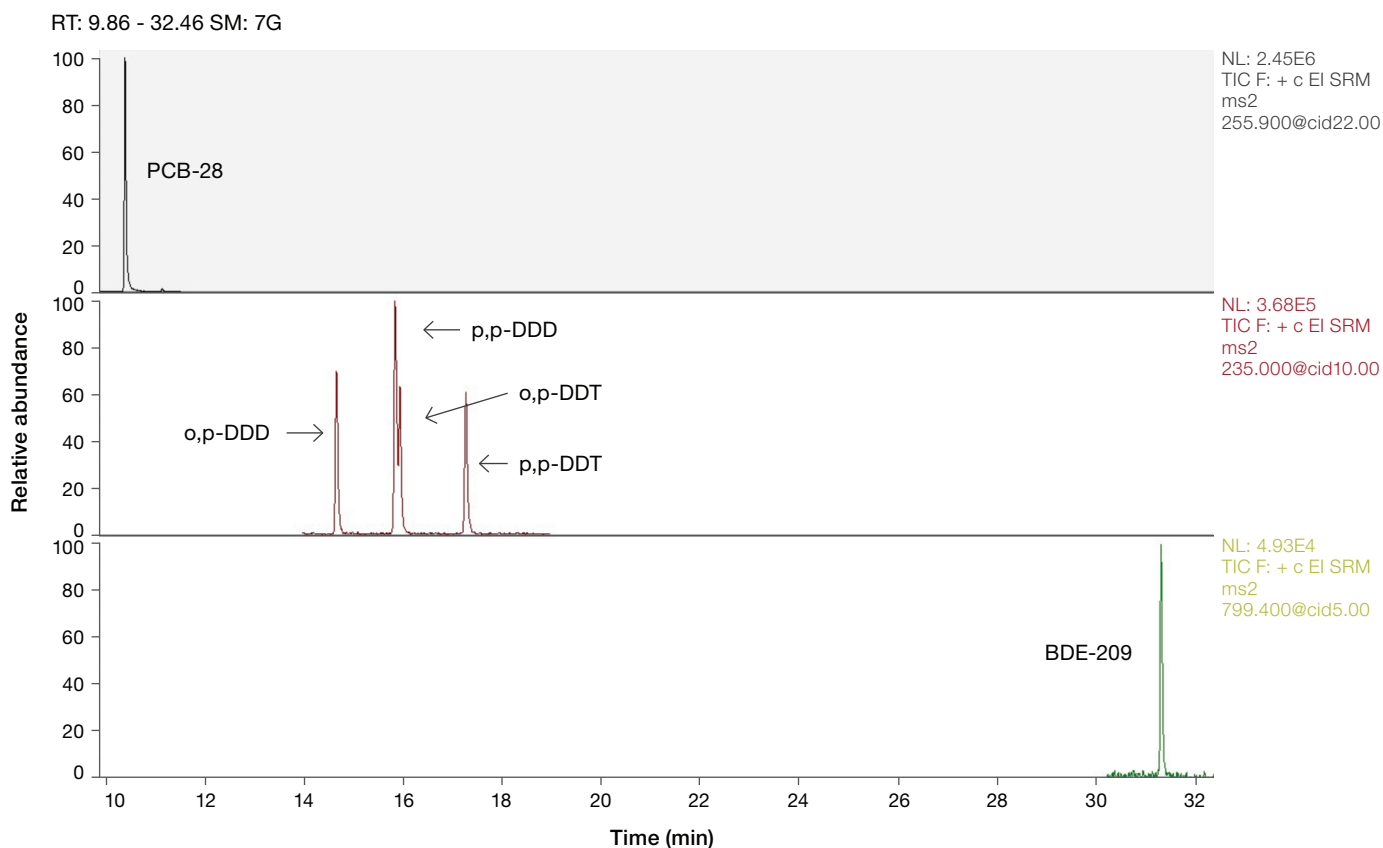


Figure 3. A consolidated method for the analysis of PCBs, OCPs, and PBDEs using the TSQ 9610 GC-MS/MS

“We love the robustness of the instrument and its ease of operation. It is very simple to train new analysts on the TSQ 9610 GC-MS/MS.”

With the TSQ 9610 GC-MS/MS, Pacific Rim analysts have been able to combine the quantitation of dioxins and PCBs into a single method thanks to the XLXR™ detector, which is an electron multiplier with extended dynamic range and lifetime. Hope explained, “Due to the extended dynamic range of the TSQ 9610 GC-MS/MS, high level PCBs and low-level dioxins can be quantified in a single method, which is impressive.” The robustness of the TSQ 9610 system due to the design of

the Advanced Electron Ionization (AEI) source has allowed for extended uptime. Hope explained, “The instrumentation is robust enough that it is able to handle complex matrixes better and requires fewer repeat injections for results confirmation.” One of the other advantages of the TSQ 9610 GC-MS/MS is the ease of use of the system. He stated, “It is very simple to train new analysts on the TSQ 9610 GC-MS/MS. This allowed us to be up and running quickly on the system and produce results.”

In the future, Pacific Rim will be looking into automated sample preparation to help increase sample throughput. Hope explained, “We believe that processes such as extraction will become fully automated in the future, and thus the analytical equipment could become modified to become part of this automated process.” Pacific Rim will continue to collaborate with Thermo Fisher Scientific on future projects. Hope stated, “Since our inception as PRL, we have always looked at newer technology to help decrease detection levels and increase our efficiencies. We have chosen Thermo Fisher Scientific since they provide the most innovative products in the field to help us to achieve these goals.”

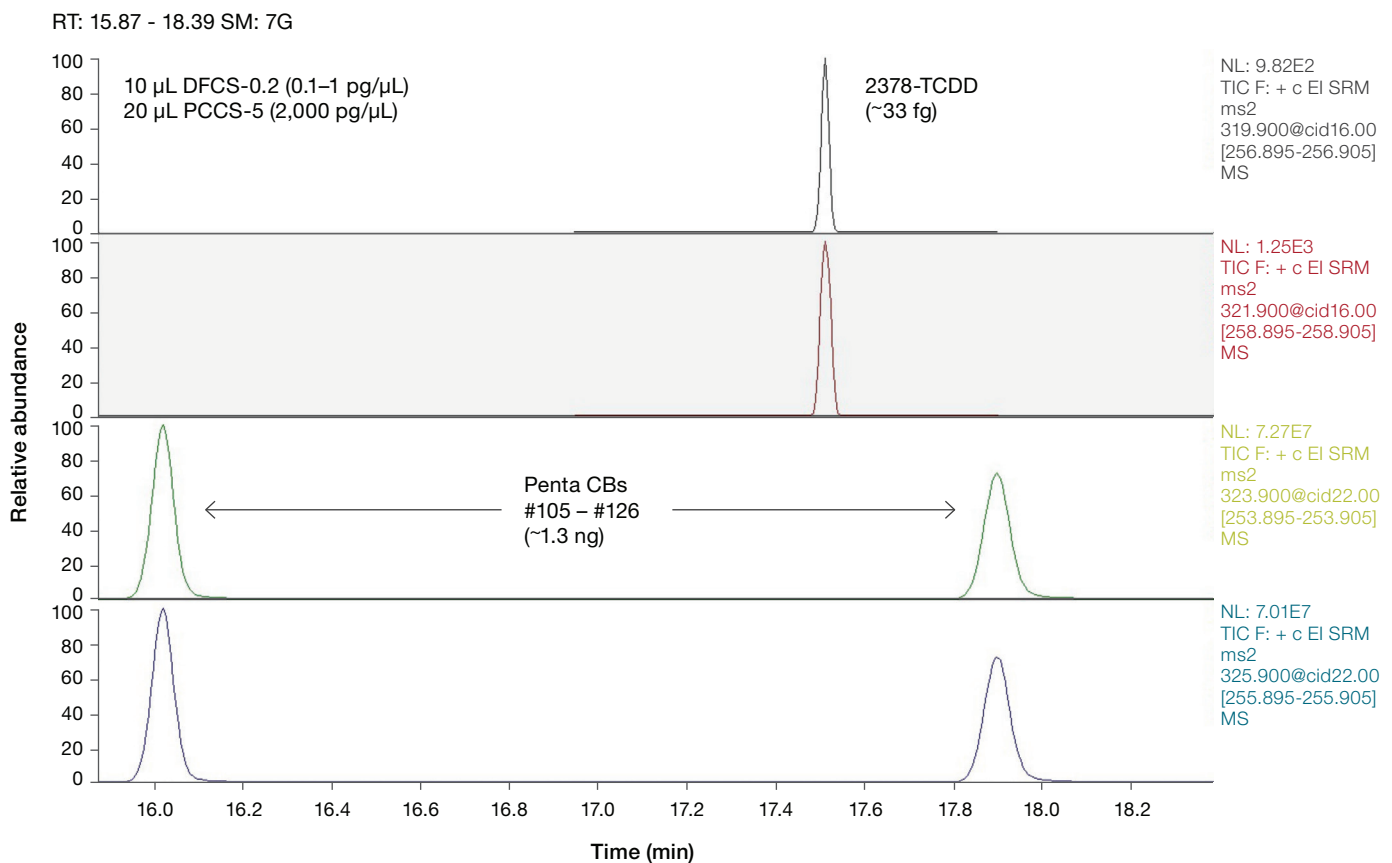


Figure 4. Analysis of trace concentrations of dioxins and high concentration PCBs in a single method using the TSQ 9610 GC-MS/MS

“The TSQ 9610 GC-MS/MS increased revenue by increasing our running capacity. The instrumentation is extremely robust and is able to handle complex matrixes.”

Conclusion

Ensuring the regulatory limits for environmental and food analysis can be met day in and day out is extremely important for analytical testing laboratories. The TSQ 9610 GC-MS/MS offers significant advantages for targeted quantitative analysis in complex matrices, including:

- Sensitivity to exceed regulatory requirements
- Increase in sample throughput
- Reduction in training
- Consolidation of analytical methods
- Confidence in results and reduction of re-analysis
- Extended uptime with robust operation

All of these enable analytical testing laboratories to adapt to ever changing demands.

About Kjell Hope

Kjell Hope is a technical research chemist at Pacific Rim Laboratories. He graduated with a Master of Science degree in Chemistry from Örebro University, Sweden and has been working in chemical analysis for 14 years. He has contributed to many projects in private industry and academia, including looking at PCBs in various foodstuffs and analyzing water for PFAS levels off the east coast of Africa. He contributed to characterizing the status of POPs, including OCPs, PCBs, and PAHs in the Campania region of Italy in collaboration with Istituto Zooprofilattico Sperimentale del Mezzogiorno, Italy. Through his work experience, he has gained vast knowledge of wet chemistry, primarily separation methods and instrumentation. He looks to incorporate new and emerging technologies into analytical processes at Pacific Rim Laboratories.



About Pacific Rim Laboratories

Based in Surrey, British Columbia, Canada, Pacific Rim Laboratories is one of the most highly respected ISO 17025 accredited and experienced high-resolution mass spectrometry testing laboratories in the world dedicated to ultra-trace organic analysis. Analysts test for a variety of POPs in various matrices using GC-HRMS, GC-MS/MS, and LC-MS/MS. For nearly two decades, Pacific Rim has worked with governments, regulatory agencies, and corporations across the globe that require environmental tests with the lowest detection limits possible (sub ppq), serving clients in Europe, South America, Asia, Africa, and across Canada and the United States.

Pacific Rim has longstanding relationships with the Canadian Food Inspection Agency and the Washington State Department of Ecology. Their testing has also been used as evidence in the World Court (The Hague) and in many other jurisdictions that require ultra-precise, highly reliable testing for contaminants in water, air, soil, plants, animals, and foods, as government agencies develop their public policies, solve disputes, or look for answers to important environmental questions. Most recently, it has become FDA approved for fish oil testing as well as continuing ongoing research on new and emerging compound and technologies.



References

1. A Visit at Pacific Rim Lab, Vancouver, Canada With the DFS Magnetic Sector GC-HRMS Product Team
<https://www.youtube.com/watch?v=yG2WtL8iORM>
2. ISO 17025 requirements: <https://www.scc.ca/en/revision-iso-iec-17025>

Learn more at thermofisher.com/TSQ9610

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