PerkinElmer Elan DRC II ICP-MS System

1) The system must include a Dynamic Reaction Cell (DRC). Collision cell technology is not acceptable: For a number of the elements we measure including K, Ca, Cr, V, Fe, Cu, As, and Se the sensitivity of an ICP-MS is limited by the presence of plasma based polyatomic species. To remove or minimize the effect of plasma base species a dynamic reaction cell (DRC) must be included as part of the system. Collision cell based systems have not demonstrated the ability to completely remove plasma based polyatiomics. The DRC is capable of reducing the intensity of polyatomic interfering species by up to 9 orders of magnitude. The DRC is operated as a mass-filtering device and has the ability to provide both high mass and low mass cutoffs. The mass bandpass window is adjustable on a per element basis and is dynamically scanned in concert with the quadrupole mass spectrometer during analysis of samples. The DRC allows the user to select from a variety of gases including ammonia and oxygen. Optionally, the use of two reaction gases, separately controlled through individual mass flow controllers is available. The dynamic reaction cell vents rapidly to allow the spectrometer to analyze a sample in "DRC" mode and in "standard ICP-MS mode" in the same analytical method, during a single uptake of the sample solution. The reaction cell is preceded in the ion path by a shadow stop to prevent sample matrix from entering the cell (thus limiting contamination) and to prevent photons from reaching the detector.

PerkinElmer is the only manufacturer of a Dynamic Reaction Cell-based ICP-MS System, the functionality and use of which is required for our primary applications.

2) A single, automatically scanned ion optic must be used. The system operator must be able to remove, replace, and perform all mechanical alignment, and all electronic tuning rapidly while using a minimal number of parts. Systems with multi element ion optics are not acceptable: Over time, as an ICP-MS system is used, no matter how it is designed, eventually contamination from the plasma will require that the lens optics be removed, disassembled, cleaned, re-assembled , re-installed and electronically tuned. With a single ion optic this is a 10 minute operation, multi element optics can take 4 hours to 2 days.

The high-throughput nature of the research requires this design characteristic to minimize down-time.

3) The ICP load coil must be argon cooled, systems with water cooled load coils are not acceptable: The use of argon to cool the load coil eliminates the possibility of clogging and leaks that can occur with water cooled load coils.

We anticipate having the instrument operating consistently, including overnight sample runs. Downtime and costly repairs need to be avoided, where ever possible. Cooling with argon is definitely our preferred approach.

4) The sampler cone orifice must be 1.0 mm or larger, the skimmer cone orifice must be 0.9 mm or large: During typical runs, contamination from the plasma accumulates on the cones, closing them and restricting the flow of ions into the ion optics. A 1.0 mm orifice has 4 times the area of a 0.5 mm orifice. Larger cone orifices are much more tolerant of contamination than smaller orifices, as a result they are much more stable over a typical work session, eliminating the need for recalibrations, resloping calibration curves, or cone cleaning before a full load of autosampler trays is completed.

We have determined that the PerkinElmer Elan DRC II ICP-MS has the largest cone size available which will, simply, allow us to run more samples. We also anticipate less frequent cone maintenance procedures, which will also contribute favorably to our intensive use of the machine.

5) The ICP torch mount must be rugged enough to remain aligned with the interface during all routine maintenance, with the exception of torch replacement; systems that require daily X, Y, Z alignment are not acceptable: The response of an ICP-MS is dependent on the X, Y torch alignment. We require a system that does not require daily alignment and which uses a quick (less than 5 mins), manual X, Y torch alignment that remains fixed in position until the torch is changed and re-installed.

Other systems use an automated, motorized X, Y alignment, and the torch position is recorded and saved for every sample. Those systems would be impractical and inappropriate for the wide range of sample types and the number of samples we need to analyze daily.