How useful can a MD800 mass detector be in a dioxin laboratory?

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For dioxins and furans analysis it is now clear that are required sophisticated mass spectrometers capable to operate at high resolution, i.e. at least at 10,000, and also to perform MS/MS. However these instruments are expensive and still require well-trained and experienced people. This is the reason why many laboratories still want to believe that these compounds can be analyzed with low resolution instruments. On the other side such a high technology should not be employed to carry out experiments that could be done with less powerful instruments.

The typical workload of an analytical laboratory involved in traces analysis such as dioxins and furans consists in issuing analytical results which must be quality controlled. Therefore it requires a lot of tedious side-work, for controlling sampling devices, analytical procedures, chemical phases, solvents, a.s.o.....Furthermore before initiating the preparation of a new sample it is necessary perform a screening and to caracterize the potentially interfering chemicals to then determine the various cleanup steps to be carried on the sample for obtaining a clean extract which can then be analyzed by GC/ MS with an acceptable recovery.

It has always been our philosophy to carry out all these side-analyses with a low resolution instrument and to keep high resolution ones to obtain quantified results. But, up to now, there was no sensitive enough, rapid and cheap technique but GC/ECD to perform screenings and elementary controls and save time on the high resolution GC/MS instrument. GC/ECD inadequacy is due to the fact that every halogenated compound is being detected without specificity and that dioxins and furans are usually present at low concentration in extracts often contaminated by other chlorinated chemicals at higher levels. If Mass Spectrometry can resolve PCDDs and PCDFs from other halogenated compounds, the lack of specificity was the major drawback of GC/ECD, the lack of sensitivity was the major drawback of the GC/MS benchtop machines.

The Fisons MD800 GC/MS benchtop system, now commercially available, is supposed to solve this problem.

The aim of this paper is to discuss the usefulness of such an instrument in a dioxin laboratory.

Sensitivity tests have been performed in both the GC/MS-Selected Ion Monitoring and GC/MS-full scan modes.

Calibration curves have been obtained for all of the toxic 2,3,7,8-substituted dioxins and furans and detection limits have been measured in in real operating conditions. Tests have been run on a 60 m long DB5 column, 0.25 mm i.d., 0.25 μm film thickness by monitoring the two most abundant peaks for each isomeric class for native and labelled molecules. In these conditions a detection limit below 1 pg of injected 2,3,7,8-T4CDD and 2,3,7,8-T4CDF, and of the order of few pg for other isomers has been measured.

Assays performed in the full scan mode demonstrate that dioxinn, furans and also interferents can be identified from their full scan spectra at the level of few injected picograms when algorithms for signal-over-noise enhancement are used.

Quantitation on a true cleaned-up fly ash extract demonstrates that the MD800 instrument permits the analysis of clean real samples at the pg dioxin level.

However, the lack of mass resolution can also be criticalfor issuing quality controlled results when the levels detected are above the regulated values.

From the exhaustive tests we have performed it can be concluded that:

- the MD800 GC/MS instrument can be very useful for realising blanks and controls in analytical conditions comparable to those of a high resolution instrument,

-it can also be used as a screening tool for both dioxin and furan identification and quantitation. When measured levels are above regulated values, high resolution instruments should be used for confirmation of the analysis and to resolve potential interferents,

- this instrument cannot replace a high resolution GC/MS system but it could usefully be used as a complementary and money saving technique in a dioxin laboratory to alleviate the burden of the high resolution system and hopefully decrease the coast of dioxin analyses.

- the use of such a mass detector should not exempt the analyst of all the quality assurance controls he is used to in his customary practice.