Titration of total hydrocarbons (C10 to C40) using GC-FID

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Introduction

41 % of polluted sites are in fact polluted by hydrocarbons (HCs). This percentage shows the importance of HCs quantification. These compounds are also very toxic, they are carcinogenic. This fact is an evidence of the importance of quantifying these chemicals.
This paper will describe one HCs quantification method.

Quantification of total HCs

HCs may be present in polluted water or soil.
An HC is a compound containing essentially carbon and hydrogen. HCs mean oil in all its forms (crude oil, residues of HCs and refined products, mineral oil, diesel and gasoline.
There are 5 types of HC : aliphatics (CH4, C3H8, etc), alicyclic (cycloalkanes, C10H16, etc), simple aromatic HCs (naphthalene, acenophtylene, etc) and sulfur-containing aromatic hydrocarbons (thiophene). Knowing the presence of HCs and their concentrations in water and/or soil is important because some of them are toxic, in particular, aromatic HCs wich can cause leukemia and different cancers.
The purpose of quantification is to determine the concentration of total HCs in water and soil, the term total referring to the 5 types of HC cited above.
The equipment used in this assay includes an "on column" injector, a gas chromatograph (GC) and FID (Flame Ionization Detector) detector. The column used is a SVE TRI-COL HP 5 MS (0.32 mm/30 m/0.25 µm), copolymer of diphenyl (5%) dimethylsiloxane (95%) and so is an apolar column. This column is preferred because HCs are also apolar.
HCs in polluted water and soil are extracted in hexane and put in a 2mL vial containing 0.2g of florisil. This compound is used to adsorb organic compounds which can interfere in the assay.
After 10 min of agitation at 300 rpm, the samples are ready to be injected. A sequence can be created on the software and the sample injected.
The concentration of the HCs can be calculated by integrating the mass from C10 to C40, having previously removed the blank (pure hexane).
For example, on figure 1, the grey area represents the mass from C10 to C40.
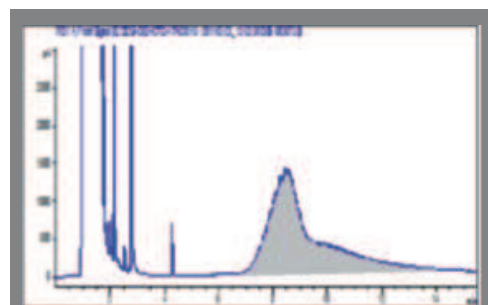
Results and discussion

The chromatogram (Figure 2) shows standard permanent gases separation with the described chromatographic assembly (Figure 1).
There is a co-elution between $O_2(P)$ and $N_2(P)$ but only $H_2(TM)$, $CO_2(P)$, $O_2(TM)$, $N_2(TM)$ and $CH_4(TM)$ are representative components for that analysis.
 In addition, retention time for $CO_2(P)$ is shorter than those from $O_2(TM)$ and $N_2(TM)$.
According to these results, we are allowed to confirm that the attached chromatographic drawing is correct to get good resolution and good separation for permanent gases, and it was very interesting because we observed good resolution (quantification too) for the CO_2, even in the case of components in an air matrix.
Finally, the area of the peaks are converted in to HC concentration with the help an external calibration curve.

Figure 1 : Chromatogram of HC sample.
Intensity (pA) as function of retention (min) time.

Conclusion

This study authorizes to conclude that the elute phase nature affects compound peak intensities. Indeed, with methanol as eluent, the intensity is higher than with acetonitrile. Furthermore, the signal sensibility gets better thanks to the increase in the quantity of organic solvents in HPLC. As a result, it permitted a better quantification of the analytes.
Nevertheless each parameter (column nature, sources, detection system) has to be adapted and tested to optimize completely the analysis.