Recent advances in the detection of VOCs with planar ion-DMA

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RAMEM's Ion-DMA is actually an ion mobility spectrometric (IMS) technology based on parallel plate DMA. Ion DMAs are DMAs in which electric field and sheath flow have been scaled up to allow for the classification of high mobility species, from 0.5 to 3.5 V/(cm^2·s) typical of molecular ions in which diffusion broadening plays a critical role on resolving power. As a result, the X1 ion-DMA is able to detect airborne chemicals with a good resolving power and sensitivity. Different atmospheric pressure ionization methods can be used in, such as radioactive, Corona Discharge Ionization (CDI), ElectroSpray Ionization (ESI) and PhotoIonization (PI) are some of the available ion sources for chemicals and for aerosols.

In this work, we present some of the results obtained for X1 ion-DMA. A detailed description of X1 ion-DMA has been published elsewhere by *Alonso et al*. (2009). Several chemicals form different families (explosives, simulants of chemical warfare agents, drug precursors etc) have been detected in X1 DMA using PI. Among the detected compound are ethanol, acetone, diethyleter, dimethyl-methyl-phosphonate, methyl salicilate, nitrotouene (NT) and dinitrotoluene (DNT). These are to our knowledge the first results of detection of NT and DNT with PI. (*Eiceman et al* (2005)). An example of the detection of the negative ions of Dinitrotouene (DNT) is shown in Figure 1.

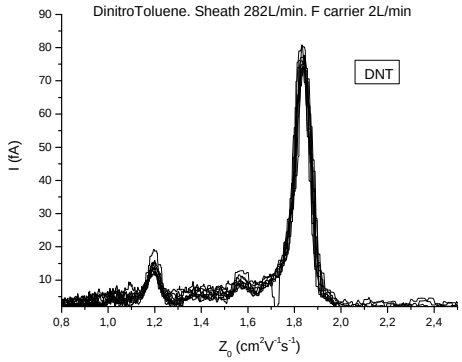

Figure 1: DNT spectra of DNT in X1 ion-DMA

As shown in Figure 1, multiplicity of ion mobility peaks is one of the problems when dealing with ions at atmospheric pressure, as is the case of DMAs or IMSs. This phenomenon may be caused by several factors. Fragmentation of ions, hydration of ions when using air as carrier gas and formation of dimers, are some of the examples of the reactions taking part when ions are generated and detected at atmospheric pressure.

The effect of the cleanness of sheath gas on spectra has been studied using N_2 as sheath and carrier gas. Some differences in the spectra and in the resolution were seen and are shown in Figure 2.

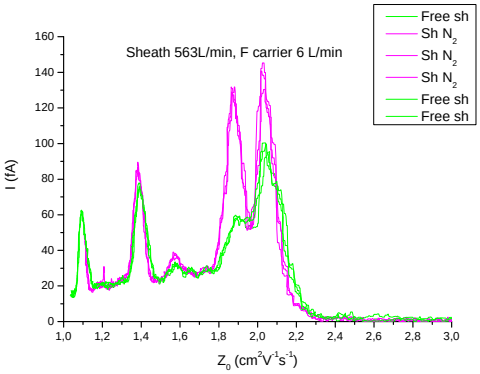

Figure 2: Differences in ^{241}Am positive ions spectra when changing the composition of sheath gas.

Several strategies to clean up interferences in the sheath gas and in the carrier gas have been checked and differences in the mobilities of the ions have been found. These differences suggest the generation of several types of ions to be detected. This is very important when identifying substances based on the mobility because it is influenced by the conditions in which it is measured.

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Eiceman, G.A.; Karpas, Z. (2005) *Ion Mobility Spectrometry*. CRC Press. Taylor & Francis Group, LLC.