MT Explorer 30: A Portable Tandem Mass Spectrometer - Development and Applications

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The development of a miniature MS instrument always requires making difficult choices between reduction of size, weight, and power (SWaP) and instrument performance. Here we report on what can be achieved in making a small SWaP instrument while retaining desktop MS performance and discuss new technologies significant for this development. MT Explorer 30 (MTE30) is a tandem 3D ion trap mass spectrometer with an atmospheric pressure interface (API) that allows using many available atmospheric pressure (AP) ionization techniques. A vacuum system is always a major contributor into SWaP of any MS instrument, but the API brings even more load on a pumping system. This was optimized by using a two-chamber vacuum system with inlet air flow directed straight into the chamber pumped out by a turbo molecular pump. Such scheme allows higher gas loads and, thus, sensitivity using small diaphragm pumps. Another feature is the use of a small metal hydride container for generation of hydrogen which is used as a buffer gas. Thus, no compressed helium gas is used in the system while ion trap mass resolution is retained as with helium. As a result, better than 0.5 Da mass resolution and 2,000 Da mass range is achievable in MTE30 at 37 lb weight and less than 1 cu.ft. system volume. Power consumption is 200-250 W with capability of battery operation up to 6 hours. Some applications using direct sampling AP chemical ionization (APCI) and secondary electrospray (sESI) ion sources will also be presented.