Distribution analysis of galanthamine, a plant alkaloid, by MS imaging

Plant alkaloids are used in various pharmaceuticals, such as anticancer drugs and analgesics. Among these plant alkaloids, galanthamine an Amaryllidaceae-type alkaloid with acetylcholinesterase inhibitor for the treatment of neurological diseases such as Alzheimer's disease. Although the chemical synthesis of galanthamine has been successfully achieved, *Narcissus* is the main source of its production. Research indicates that galanthamine content varies not only with the type of *Narcissus*, but also with the developmental stage and the part of the *plant*. Pharmaceutical companies are pursuing plant species with higher galanthamine content to increase pharmaceutical productivity. Therefore, we quickly confirmed the *Narcissus* in our study contained galanthamine using DPiMS QT system featuring a high-resolution quadrupole time-of-flight (Q-TOF) mass spectrometer equipped with an ion source utilizing probe electrospray ionization (PESI) method. Subsequently, we analyzed the distribution of galanthamine using MS imaging (MSI) system consisting of an Q-TOF mass spectrometer connected to an iMScope QT atmospheric MALDI unit with built-in microscope.

Galanthamine was rapidly detected in the leaves extract solution using the DPiMS QT in only 30 seconds. Other compounds were also able to be detected and identified: lycorine and tazettine, bothalkaloids found in *Narcissus.*

MS Imaging was performed on sections of leaves (in two locations) and bulbs with a spatial resolution of 25 um for the entire section and 10 um for the area observed under a microscope with a 5x objective lens. As a result, good MS images of galantamine, lycorine, and tazettine were obtained from all samples. The MSI of the bulbs showed that galantamine was distributed more in the leaves, but MSI of lycorine and tazettine did not confirm such a distribution, indicating that the regions of distribution differ depending on the type of plant alkaloid. In addition, this analysis of galanthamine distribution by MSI can identify regions with higher galantamine content and may contribute to an efficient determination of extraction regions for pharmaceutical manufacturing processes.