AMBIENT MASS SPECTROMETRY IMAGING OF FOOD CONTAMINANTS

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INTRODUCTION

Food contaminants are usually measured in an averaged single dimension only, through extraction and analysis of entire food products or food ingredients. However, levels of contaminants such as pesticides or hazardous natural compounds may vary locally to a large extent, thereby limiting the value of average-based data when particular parts of food (ingredients) are being used and consumed. Also regulatory limits are usually based on entire product analysis data. Laser ablation electrospray ionization (LAESI) mass spectrometry imaging (MSI) does not require very flat surfaces, high precision sample preparation or the addition of matrix. Thanks to these features, LAESI-MSI may be the method of choice for spatially-resolved food contaminant analysis.

METHODS

In this work, LAESI time-of-flight MSI at a mass resolution of 18,000 (FWHM) has been explored for macroscopic and microscopic imaging of pesticides, natural toxins and plant metabolites on rose leaves, oranges, apples, lemons, ergot bodies, cherry tomatoes and maize kernels. The LAESI system was equipped with a 2940 nm mid-IR laser yielding a spot size of 200 µm and the laser was firing ten times per x-y location at 10 Hz. Accurate mass ion map data were acquired at a sampling location center-to-center distance of 0.2-1.0 mm and superimposed onto co-registered optical images.

PRELIMINARY DATA

Spatially-resolved ion maps of pesticides on rose leaves suggest co-application of registered and banned pesticides. Ion maps of the fungicide imazalil show that this compound is only localized on the peel of citrus fruits. However, according to 3D LAESI-MSI the penetration depth of imazalil into the peel shows significant local variations. Ion maps of different plant alkaloids on ergot bodies from rye show co-localization in accordance with expectations. Among them, an untargeted alkaloid was found that has hardly been reported in literature. Untargeted ambient MSI in food analysis is demonstrated by ion maps of plant metabolites in cherry tomatoes and maize kernel slices. In the tomato case, traveling-wave ion mobility (TWIM) was applied to discriminate between different lycoperoside glycoalkaloid isomers; in the maize case quadrupole time-of-flight tandem mass spectrometry (MS/MS) was successfully used to elucidate the structure of a localized unknown.

NOVEL ASPECT

LAESI ambient MSI spatial distributions of a range of targeted and untargeted food contaminants on native sample materials were obtained.

Keywords: *LAESI time-of-flight MSI, food contaminants, plant sample materials*