Visualization of nutrient distribution in food

We know several kinds of molecules in food and agricultural, forestry, and fishery products. Some of these molecules improve our health, whereas some molecules harm our health. Conventional analytical techniques such as liquid chromatography (LC) or gas chromatography (GC) are used to detect molecules in food. The major advantage of these techniques is that they can detect trace amounts of molecules of interest in food. However, these methods require extraction of molecules of interest from food, and this extraction step causes the loss of the spatial information of molecules.

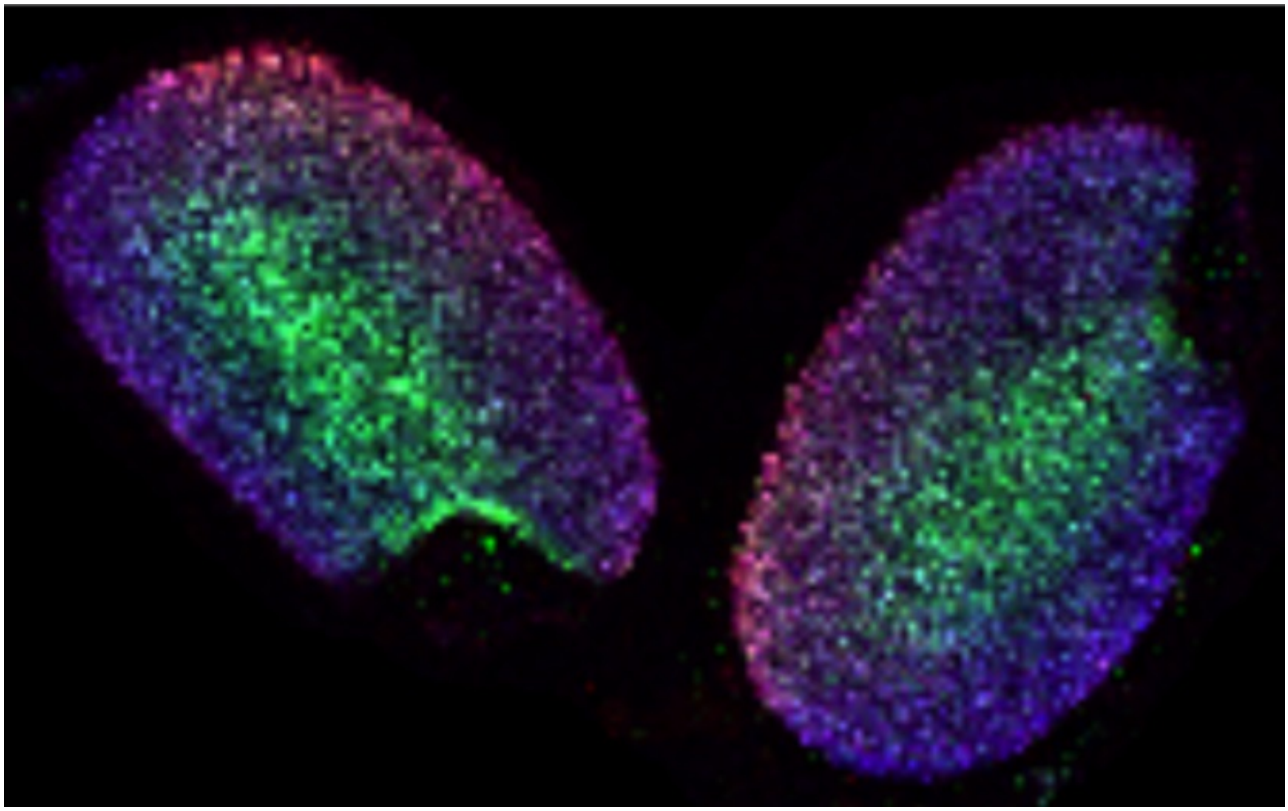

Fig. 1.

To overcome this disadvantage of conventional analytical methods, mass spectrometry imaging (MSI) is an ideal complementary method. MSI can be used to visualize the spatial distribution of molecules of interest in tissue sections of food. In our review below, we have described the detailed analytical procedure of MSI. Figure 1 shows example data for MSI. In this figure, three kinds of molecules (lipid species) in rice endosperm are visualized in different colors (blue, red, and green). The exact biological significance of this characteristic distribution of molecules in rice remains unknown, but it is likely that this distribution of molecules is related to the production of high-quality

Japanese sake. Sake is a traditional alcoholic beverage made from rice, and it has been consumed in Japan for over 1000 years. It is well known that polishing of rice is important to produce high-quality sake, and increasing the extent of rice polishing improves the quality of sake. The reason why polishing of rice is needed to produce high-quality sake is not fully understood yet. We found that molecules, which are colored blue and red, contain undesirable factors for the production of high-quality sake. These molecules are removed from rice by the polishing process. The data presented in Figure 1 might explain the importance of rice polishing process that has been established as an ancient practice. However, further studies are needed to support this hypothesis.

The potential of an MSI data in food science is well represented in Figure 1. MSI can be used for the detection of functional food factors, pesticide residues, and food metabolites in agricultural, forestry, and fishery products. Thus, in the future, MSI will become an essential tool in several fields.

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