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Application of supercritical fluid chromatography/mass spectrometry to metabolic profiling

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Abstract

Owing to its favorable properties such as low viscosity and high diffusivity, a supercritical fluid can be used as the mobile phase in chromatography. Supercritical fluid chromatography (SFC) can provide high-speed and high-resolution separation. Because supercritical carbon dioxide (SCCO2), which is generally used as the mobile phase in SFC, is automatically emitted at room temperature, SFC is most commonly used as a preparative method. However, SFC can also be used to perform high-precision biomolecular analysis, especially for hydrophobic metabolites, because of the low polarity of SCCO2. The use of a mass spectrometer (MS) with SFC can widen the scope of application of SFC to bioanalysis. Therefore, we have tried to apply SFC/MS to a metabolic profiling.

We developed a useful workflow using SFC, a quadrupole orbitrap mass spectrometer, which can perform high-resolution full scanning and product ion scanning in both the positive-ion mode and the negative-ion mode in practical cycle time, and an automated lipid identification system. Additionally, we developed a polar lipid profiling method by SFC/MS with trimethylsilylation and methylation. The targeted lipid profiling by SFC/MS was also constructed. SFC/MS was useful for the separation of lipids having numerous analogs with similar structures, such as carotenoids and triacylglycerols. Additionally, SFC/MS showed the maximum efficiency for the analysis of a biological sample that includes many matrices. The high-resolution, high-throughput analytical system based on SFC/MS is suitable for studies on lipid metabolomics because it is useful not only for the screening of diverse lipids (as a fingerprint method) but also for the detailed profiling of individual components. Furthermore, SFC/MS is applicable for the analysis of various metabolites besides lipids and is expected to emerge as a powerful analytical tool in metabolomics.

Biography

Dr. Takeshi Bamba is an associate professor at Department of Biotechnology, Graduate School of Engineering, Osaka University, Japan. He has completed his Ph.D. from Osaka University. His laboratory focuses on the development of metabolomics technology including data mining and its application research in various fields. He has published more than 100 articles in scientific journals/books.