![SHIMADZU Excellence in Science]

Method development of high throughput lipid analysis in foods by direct analysis in real time mass spectrometer (DART-MS)

ASMS 2016   ThP 002

Motoshi Sakakura[1], Teruhisa Shiota[1], Jun Watanabe[2]
[1] AMR, Inc., Tokyo, JAPAN;
[2] Shimadzu Corporation, Kyoto, JAPAN

![AMR INCORPORATED]

Introduction

Acylglycerols included in a food play the role important to the food function such as flavor and nutrition. There were some problems such as complex preparation steps and carry over to analytical instruments with an analysis of acylglycerols, and it was difficult to analyze a great deal of samples quickly.

In this study, we analyzed food samples including acylglyserols directly with DART (Direct Analysis in Real Time) and mass spectrometer with less sample pretreatment and tried to detect the characteristic ingredients in samples and distinguish each sample.

Methods and Materials

Mass spectrometer LCMS-2020 (Shimadzu Corporation, Kyoto, Japan) equipped with real time direct analysis ion source DART-OS (IonSense, Inc., Saugus, MA, USA) was used for this study. Marketed soybean milk, butter and margarine, etc. were used for food samples including acylglycerols. Samples were analyzed by making a small amount samples adherent onto a glass stick and holding

it up to the DART gas stream about 10 seconds. Further, without pretreating a sample, it was set to the analysis. LCMS-2020 can achieve the polarity switching time of 15msec and the scanning speed of up to 15000u/sec, therefore the loop time can be set at less than 1 second despite the relatively large scanning range of 10-1000u.
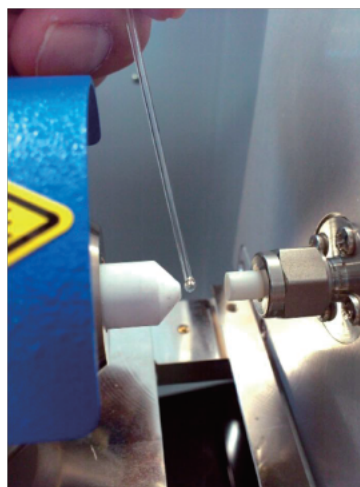
Figure 1　DART-MS System; LCMS-2020 equipped with DART-OS

Result

Various samples were analyzed by DART-MS. Analyzing time of each sample was about 10 seconds and analyzing interval of each sample was less than 1 minute.

Positive Mass Spectum

From the results of food samples of plant origin like soybean milk and margarine, several signals of triacylglycerides (m/z 900 near here) and diacylglycerides origin mainly comprised of oleic acid and the palmitic acid were detected in the positive ion spectrum. In the case of measuring food samples of animal origin like milk and butter, many signals of triacylglycerides and diacylglycerides which comprised of middle chain fatty acid as well as long chain fatty acid were detected, and the spectrum pattern was indicated different from vegetable fats and oils.
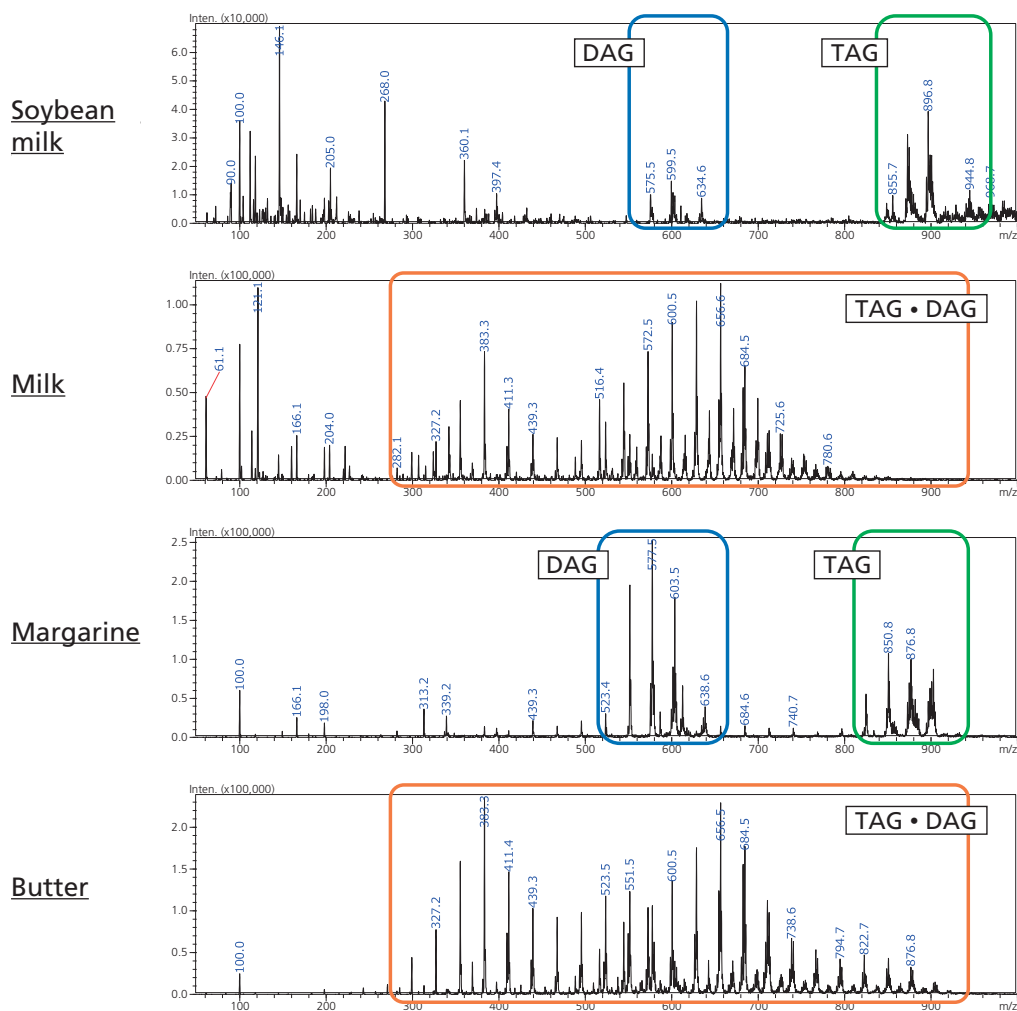

Figure 2   Positive mass spectra of samples analyzed by DART-MS

Method development of high throughput lipid analysis in foods by direct analysis in real time mass spectrometer (DART-MS)

The marketed food sample which was margarine added butter was analyzed. It had just mixed mass spectrum in which some glyceride signals mainly comprised of oleic acid and the palmitic acid were detected and many glyceride signals which comprised of middle and long chain fatty acids were detected.
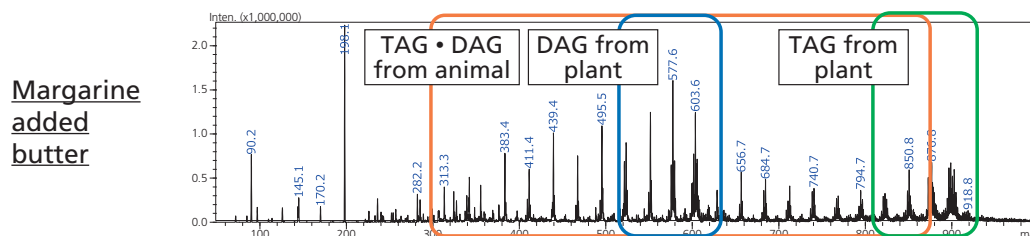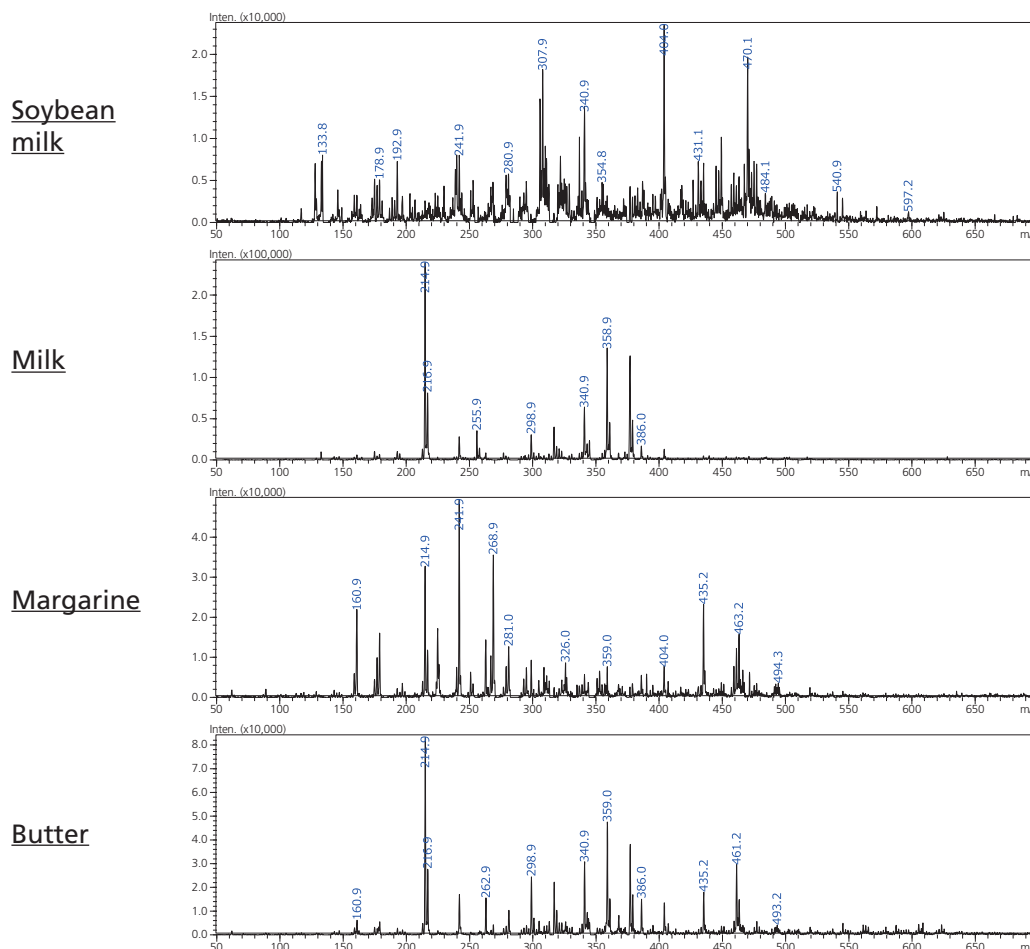

Figure 3   Positive mass spectum of margarine added butter analyzed by DART-MS

Negative Mass Spectrum

The negative mass spectra were indicated (figure 4). A signal was detected by m/z 215 in all spectra except for soybean milk both. It was inferred that these signals were chloric adduct ion [M+Cl]- of monosaccharide (C6H12O6).

Figure 4   Positive mass spectra of samples analyzed by DART-MS

4

Total ion current chromatograms (TIC) and extracted ion current chromatograms (XIC) of m/z 215 in negative mode when each sample being analyzed were shown in figure 5. XIC signal of monosaccharide origin wasn't detected in soybean milk. It was detected weakly in butter and hard in milk and margarine.
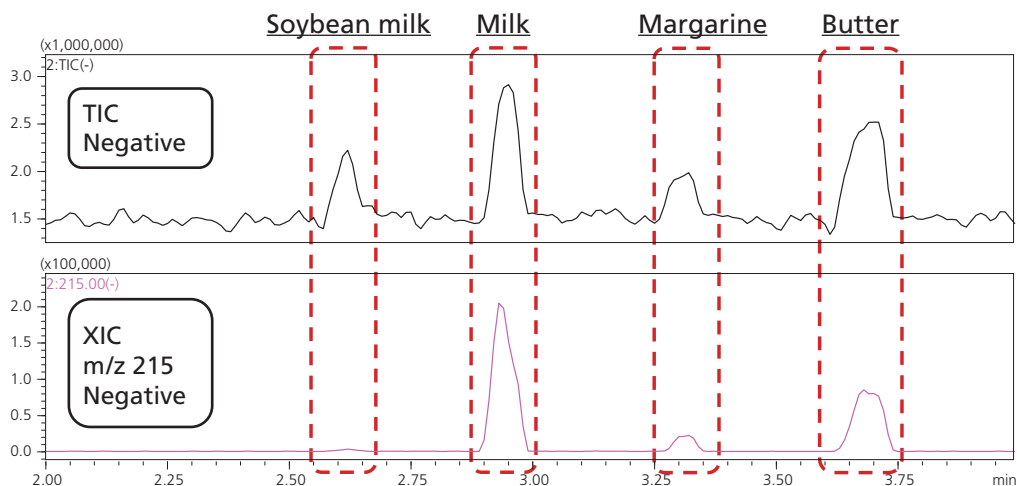

Figure 5   TIC chromatogram and XIC chromatogram (m/z 215)

High throughput lipid analysis in foods containing oils and fats was achieved by a mass spectrometer with high speed polarity switching and high speed scanning integrated with DART ion source which could real-time-analyze and it was possible to profile plant acylglycerol and animal acylglycerol.

Conclusions

Various food samples were analyzed by DART-MS;
High throughput lipid analysis in foods containing oils and fats was achieved by a mass spectrometer with high speed polarity switching and high speed scanning.

From the results of food samples;
[Food samples of plant origin] several signals of triacylglycerides and diacylglycerides origin mainly comprised of oleic acid and the palmitic acid were detected.
[Food samples of animal origin] many signals of triacylglycerides and diacylglycerides which comprised of middle and long chain fatty acids were detected.

5

References

1. A. McANOY et.al, J. Am. Mass Spectrom., 2005, 16, 1498-1509.
2. B. Winther et.al, Lipids, 2011, 46, 25-36.
3. V. A.Tyurin et.al, Journal of Neurochemistry, 2008, 107, 1614-1633.
4. H. Mikuma, A. Kaneko, BUNSEKI KAGAKU, 2010, 59(5), 399-404.

Disclaimer: The products and applications in this presentations are intended for Research Use Only (RUO). Not for use in diagnostic procedures.

Shimadzu Corporation

www.shimadzu.com/an/