

Application News

MALDI-TOF Mass Spectrometry

No.B43

Analysis of Recycled Polyesters by MALDI-TOFMS (2)

The recycling of plastic products has increased in recent years due to the enactment of recycling-related laws aimed at protecting the global environment. Along with this, there is a growing need for faster and more detailed analysis of recycled products. For example, instead of analyzing an entire polymer, a less challenging analysis of only the related oligomers could provide sufficient information. Traditionally, oligomer analysis has been conducted using various techniques, including rough separation using the

precipitation method, combined with a variety of chromatographic and spectrometric techniques. More recently, MALDI-TOFMS has become widely used for oligomer analysis. Application of MALDI-TOFMS allows terminal group and monomer unit information to be obtained very quickly. Here, we introduce an example of recycled polymer analysis for polycarbonates using a combination of oligomer rough separation by the precipitation method with MALDI-TOFMS.

For the polycarbonate (PC) samples, commercially-available PET chips, a stationary implement (recycled), and a compact disc were used. Sample preparation was conducted using the precipitation method (see Application News No. B42). In addition, Shimadzu's analysis software "Polymer" was used for post-acquisition analysis. Fig. 1 shows a typical PC oligomer mass spectrum, in addition to an example of

peak assignment.

The spectrum of Fig. 1 clearly shows 3 repetitions of the 254-dalton monomer unit of PC. Because PC uses common end terminal sealants, the following chemical structures are assumed. The assignments were quickly output using the Polymer software, in which the 3 oligomers each have both terminals sealed, one terminal sealed, and one structure which is cyclic.

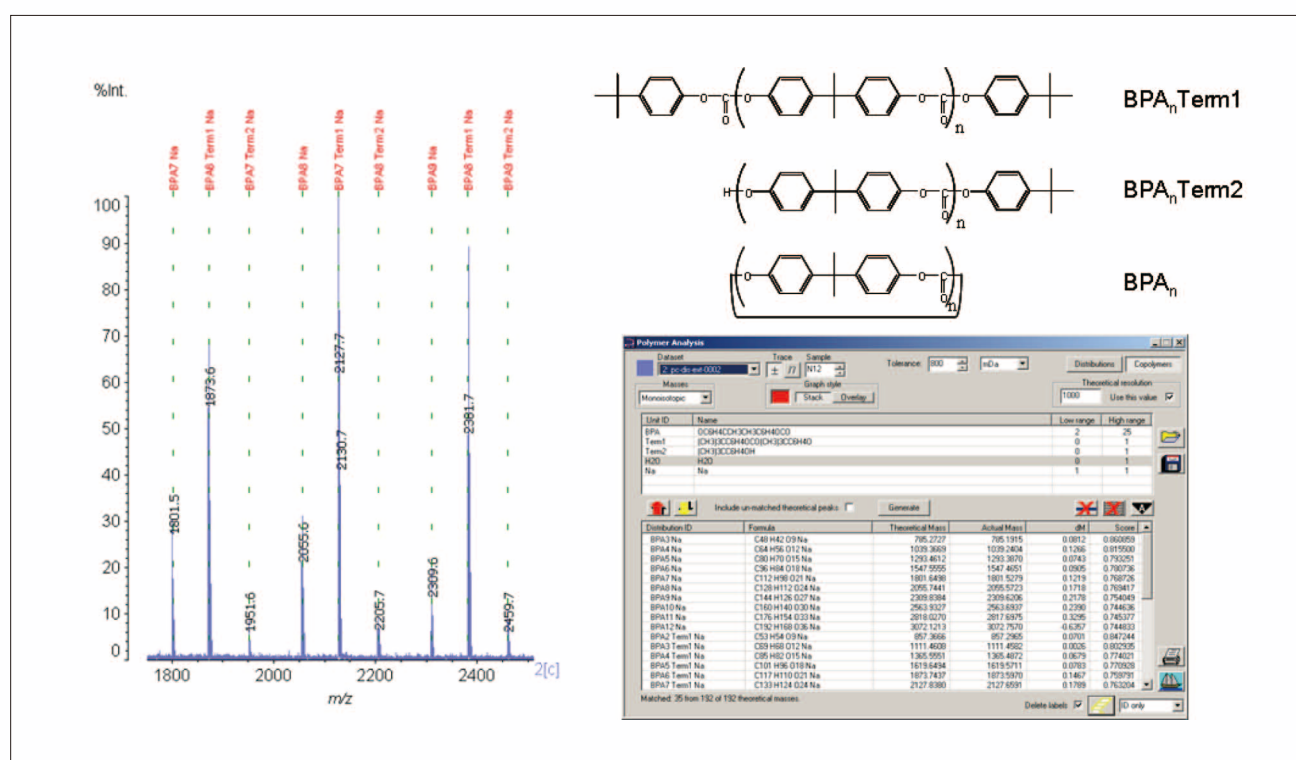


Fig. 1 Typical Mass Spectrum of PC Oligomer and Assignment Using "Polymer" Software

Next, oligomers that were extracted from various products (stationery implement, compact disc, commercially-available PET chips) containing PC as a raw material were compared (Fig. 2). It was clear from the results that the recycled PC used as a raw material in the stationery implement contained more of the cyclic oligomers than of the other two types, and that there were also many of the single-OH-terminal type. As for the commercial PET chips, while the single-OH-terminal type was relatively abundant, there

were not many of the cyclic type. On the other hand, the main constituent type of oligomer extracted from the compact disc was the both-terminal-sealed type. Since high quality is required of polymers for optical discs, it is known that low-molecular-weight oligomers are intentionally removed, and this is reflected in the MALDI-TOFMS results. Thus, it was demonstrated that the use of MALDI-TOFMS together with a simple preparation procedure permits the comparative assessment of recycled polyesters.

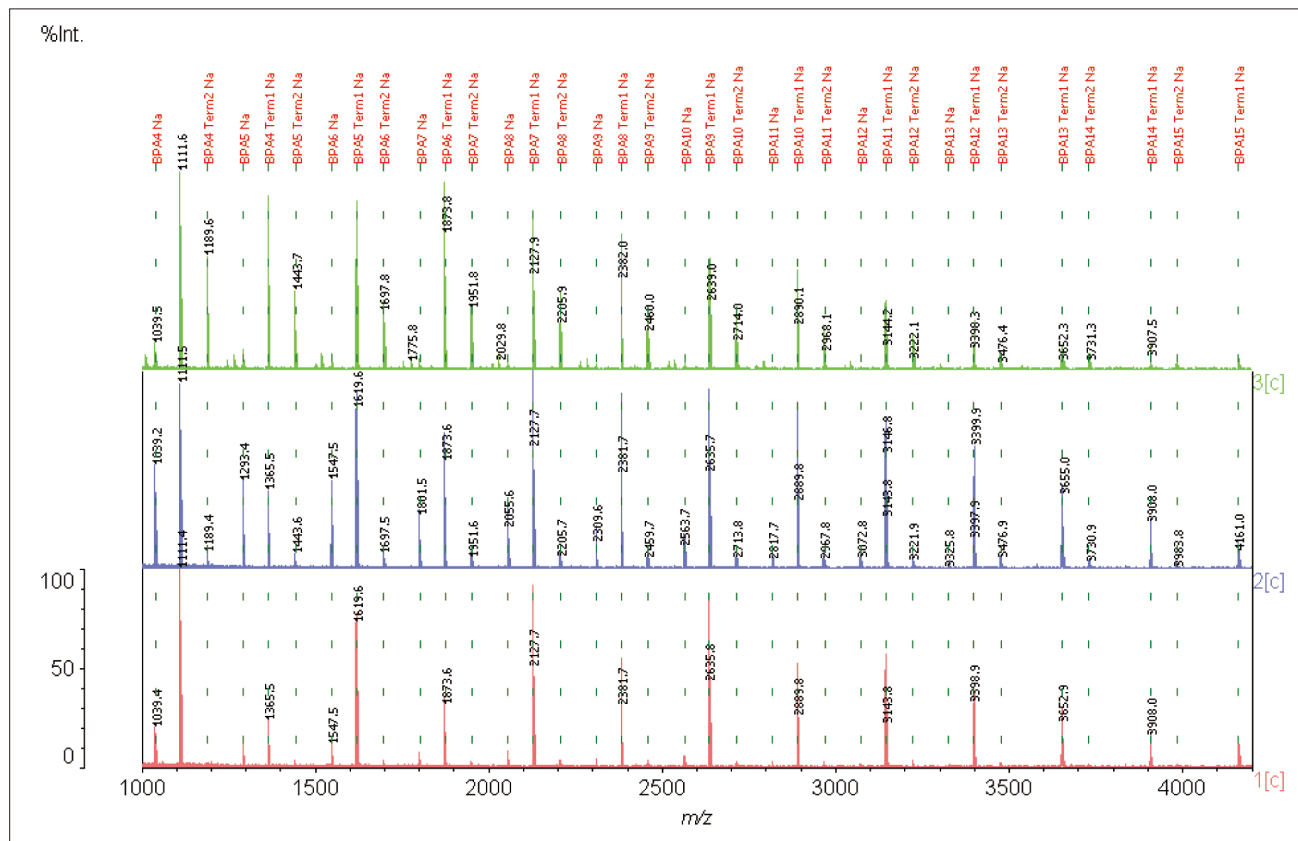


Fig. 2 Comparison of Various PC Oligomers-Upper; Commercial PET Chips, Middle; Stationery Implement (recycled), Lower; Compact Disc