CDS olutions

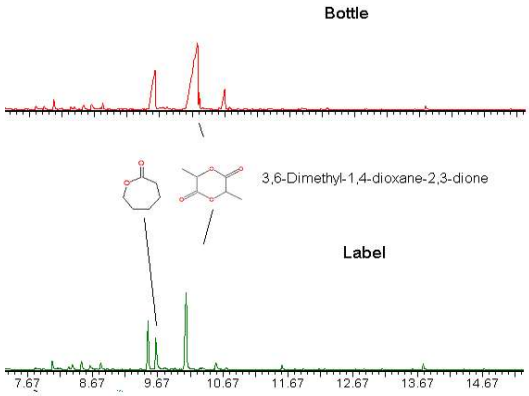
APPLICATIONS INFORMATION USING ADVANCED SAMPLE HANDLING TECHNOLOGY

Pyrolysis GC/MS of Biodegradable Plastic Packaging

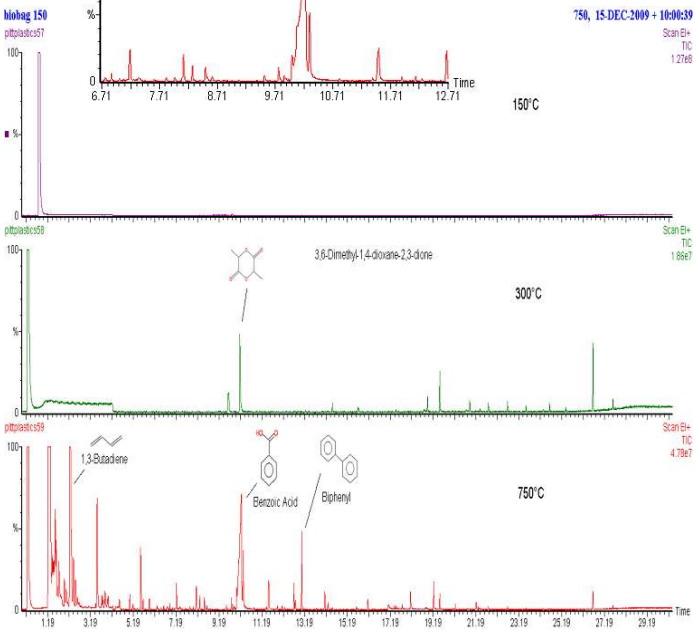
The recent growing concern for our ecosystem quality as well as limits of unrenewable resources, such as petroleum, has lead to development of disposable plant based plastics that decompose quickly. Pyrolysis results can be used to identify structure of or characterize these newly developed plastics.

Pyrolysis at 750°C was performed on packaging from a juice bottle and label made of polylactic acid. This is a polyester derived from cornstarch, or sugar cane. Figure 1 has pyrograms of the bottle and label. Both of them have a large peak for lactide (3,6 Dimethyl-1,4-dioxane-2,5-dione), but the pyrograms are not identical. The label has an additional peak, 2-oxepanone. This is also found in the degradable polyester, polycaprolactone.

We also performed multistep heating sequence on a piece of a trash bag made from a biodegradable plastic of unknown composition. First the plastic was heated to 150°C, then 300°C, and then finally at 750°C (Figure 2). With this small sample, we see no desorption products released at 150°C. However, at 300°C, it appears as though the bag started to degrade, revealing a small amount of lactide, a pyrolysis product of polylactic acid. The pyrolysis run provides a large peak of benzoic acid, and biphenyl. These are typical of polyesters that have terepthtalate. Also found is butadiene. The combination of these pyrolysis products could result from the compostable polyester, polybutylene adipate/terephthalate (exact composition is unknown). Also, lactide is hidden under the large peak for benzoic acid, but is located by extracting ion 56 (Figure 3).



1. Polylactide bottle and label



3. m/z 56 extracted to draw out lactide hidden in benzoic acid peak

2. Multistep heating of biodegradable trash bag

Equipment

These sample was analyzed using a CDS Model 5200 Pyroprobe, interfaced to a Perkin Elmer Clarus GC Turbomass MSD

Model 5200 Conditions

Valve Oven:	325°C
Transfer Line:	325°C
Temperature:	750°
Time:	15 seconds
Interface Final:	325°C for 3 minutes

GC Conditions

Carrier:	Helium
Injector:	325°C
Split:	50:1
Column:	HP-5MS (30m X 0.25mm)
Detector:	Quadrupole
Range:	35 - 550amu

GC Program:

Initial:	40°C for 2 minutes
Ramp:	8°C/min.
Final:	300°C for 5 minutes

FOR MORE INFORMATION CONCERNING THIS APPLICATION, WE RECOMMEND THE FOLLOWING READING:

Additional literature on this and related applications may be obtained by contacting your local CDS Analytical representative, or directly from CDS at the address below.

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