

## Pyrolysis GC/MS of Biodegradable Plastic Packaging

### Application Note

#### Plastics

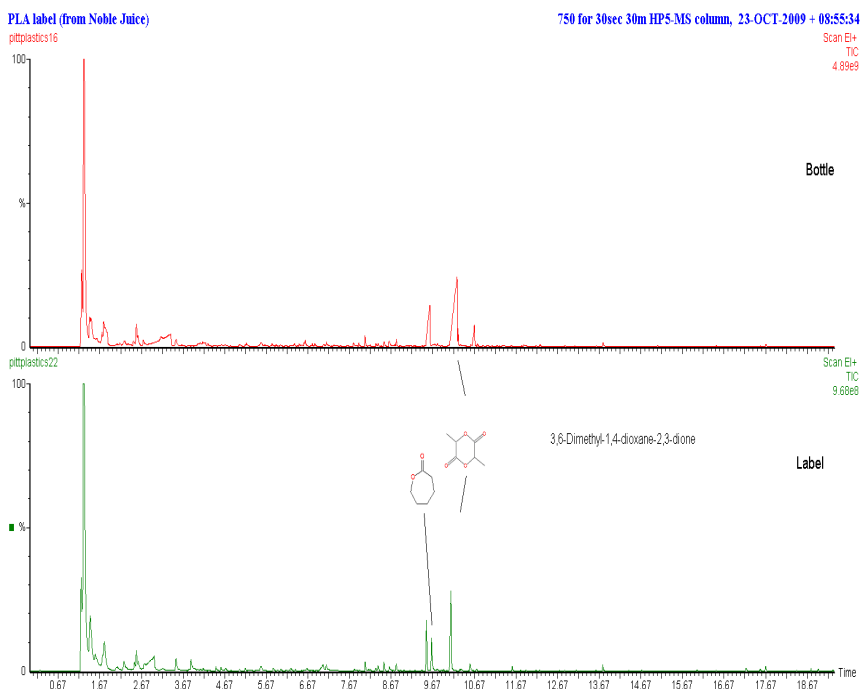
#### Author:

K. Sam

The recent growing concern for our ecosystem quality as well as limits of unrenewable resources, such as petroleum, has led 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 terephthalate. 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

### CDS Pyroprobe

Interface:

Rest:

Final: 325°C for 3 minutes

Pyrolysis: 700°C for 60 seconds

Valve oven: 325° C

Transfer line: 325° C

### GC/MS

Column: 5 m x 0.25 mm 5% phenyl

Carrier: Helium, 50:1 split

Injector: 350°C

Program: 40°C for 2 min  
8°C/min to 300°C(5min)

Mass range: 35 to 550

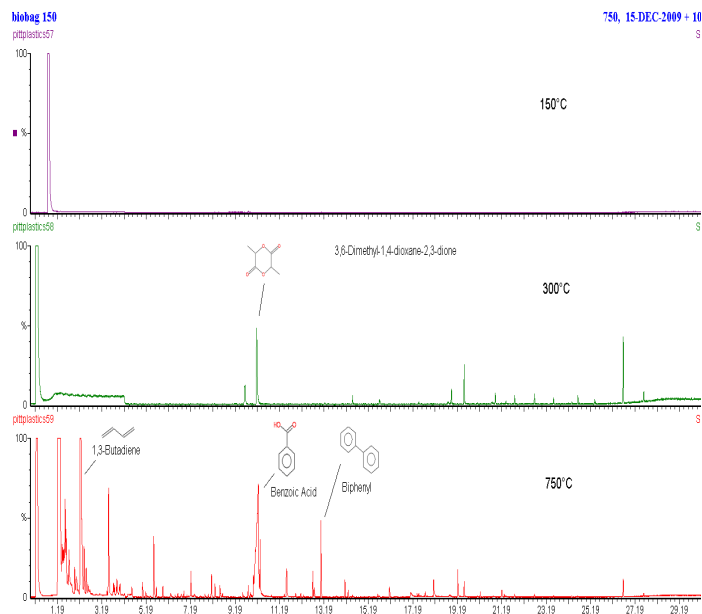


Figure 2. Multistep heating of biodegradable trash bag.

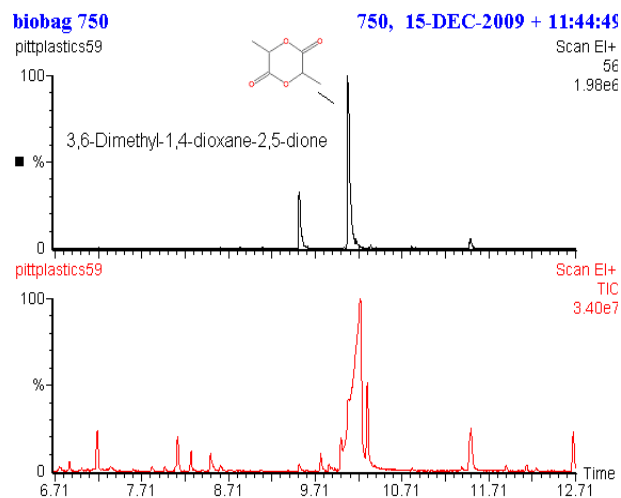


Figure 3. m/z 56 extracted to draw out lactide hidden in benzoic acid peak