

Application Note

Environmental Industry

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Abstract

Easy Detection of Dissolved Plastic in Sea Water by Pyrolysis GC/MS

Pollution of our waters, from streams to oceans, has been of increasing concern over the last decade. From volatiles to semi-volatiles, and more recently dissolved polymers (plastics), these contaminants are coming from both industrial operations and commercial waste. For the analytical scientist, detecting these dissolved polymers is an analytical challenge since they cannot be extracted using traditional methods, like purge and trap, SPE or liquid-liquid extractions. However Analytical Pyrolysis, which uses intense heat to break apart these polymers, can convert them to compounds amenable for GC analysis.

In figure 1, two styrenic polymers were dissolved in both deionized water and seawater at about 45000 ppm. Ten (10) microliters of each solution were separately added to quartz wool inside two quartz sample tubes, then automatically dried and pyrolyzed. Each polymer was detectable, and showed patterns which differentiated one from the other.

To get a better idea of detection limits, a dilution of each solution was made. An estimated 1000ppm concentrated sample was prepared with 1 microliter being analyzed using the same method. This would be about 1 microgram of each. The largest peaks and monomers of the polymers (Styrene and tert-butyl-Styrene) were still visible, as shown in figure 2.

As only 1 microliter was used, a tube with enough quartz wool can handle as much as 40 microliters of water fairly easily, extending the detection limit to greater than 20ppm. Additionally, once liquid is added, it may be dried manually, so more liquid can be added to further increase sensitivity. In these analyses, the detector was used in SCAN mode. For greater sensitivity, selective ion monitoring may be used.

CDS Pyrolyzer Conditions:

Pyroprobe:

Dry:	200°C for 2 minutes
Initial:	50°C
Ramp:	10°C/msec
Final:	700°C for 1 Minute

Iso Zones:

Transfer Line:	300°C
Valve Oven:	300°C

GC Conditions:

Carrier Parameters

Carrier A control: PFlow- He
Split Ratio: 50:1

Oven Program

Initial Temp: 40°C
Initial Hold: 2.00 min
Ramp 1: 12.0/min to 300°C, hold for 10.0 min

Heated Zones

Front Injector Setpoint: 300°C

MSD

Type MS Scan: Ion Mode EI+
Start Mass: 35.00
End Mass: 550.00

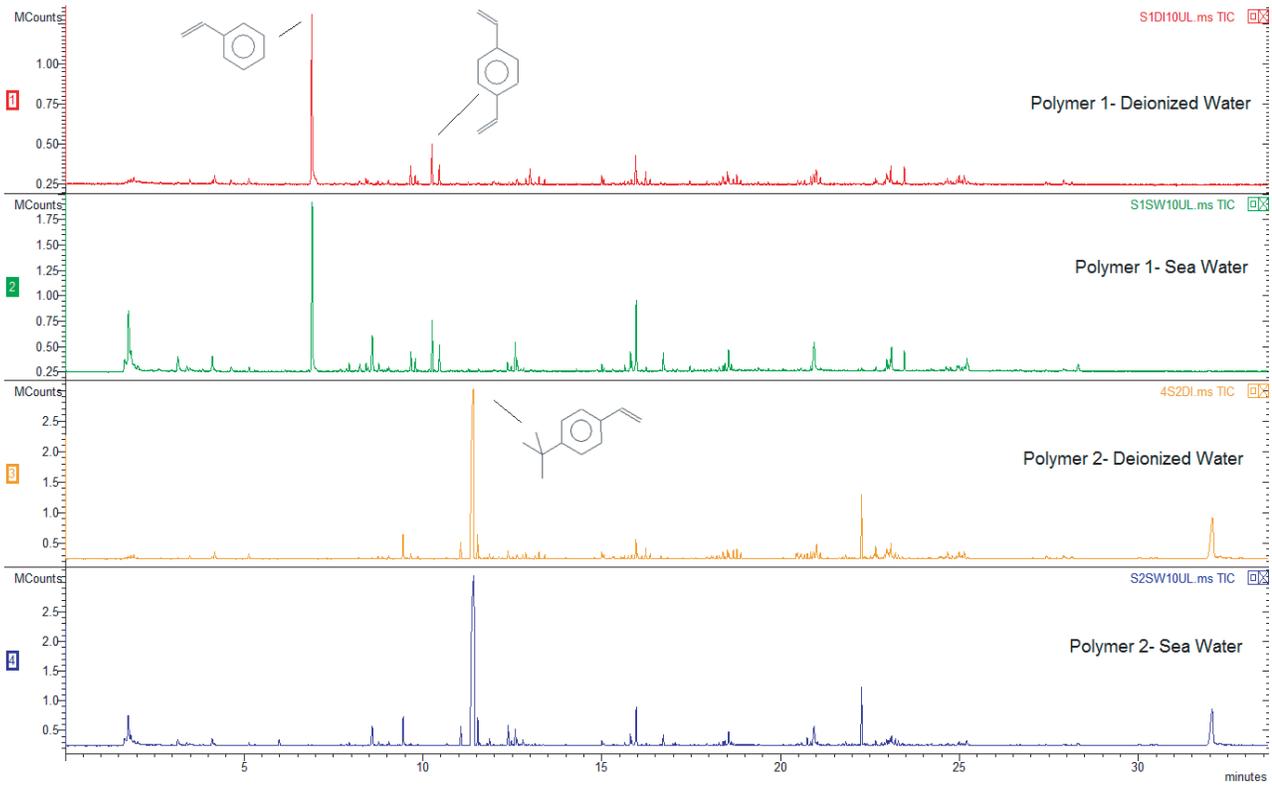


Figure 1: Polymers dissolved in water, dried, then pyrolyzed at 750°C.

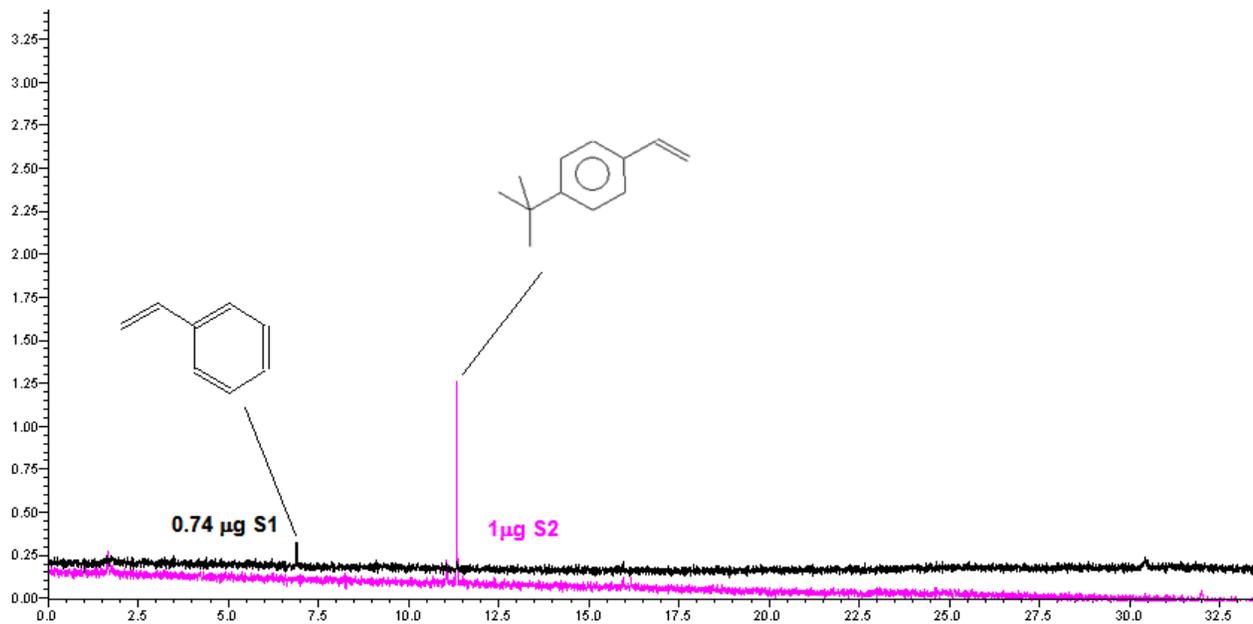


Figure 2. Dilute Solutions of Polymers in Salt Water