CAPSULES
preliminary notes and applications from Bioanalytical Systems, Inc.

Detection of Toxic Compounds in Polyurethane Food Bags

Purpose

Determine toxic by-products of boilable cooking pouches including, 2,6-toluenediamine (2,6-TDA), 2,4-toluenediamine (2,4-TDA), aniline, and phenol.

The two diamines, 2,4-TDA and 2,6-TDA, are intermediates in the production of toluenediisocyanates used in the manufacture of polyurethanes.

Although both are potentially harmful in some biological systems (linked to an increased incidence of bladder, kidney, and liver tumors in rodents), their toxic effects in humans have not been established. Aniline and phenol are also considered to be acutely toxic, but neither has been adequately tested for toxic or carcinogenic effects. All four compounds are easily determined by LCEC.

Existing Methods

Including LCUV, TLC, and GC. These methods are either too time consuming, require clean-up and preconcentration steps, derivatization, or exhibit inadequate detection limits.

Reference

Detection of Toxic Compounds in Polyurethane Food Bags by Liquid Chromatography/Electrochemistry, C.J.P. Ward, D.M. Radzik, and P.T. Kissinger, J. Liq. Chromatogr. 8(1985) 677-690.

Conditions

Liquid Chromatography: LC-154 Electrochemical Analyzer
Detector: BAS LC-4B/17
Electrode: TL-5A Glassy Carbon
Potential: +0.85 V vs Ag/AgCl
Column: Biophase ODS, 5 µm, 250 x 4.6 mm (BAS, P/N MF-6017)
Mobile Phase: 93% 0.1 M ammonium acetate, pH 5.4, 7% acetonitrile. Flow rate was 1.5 mL/min.

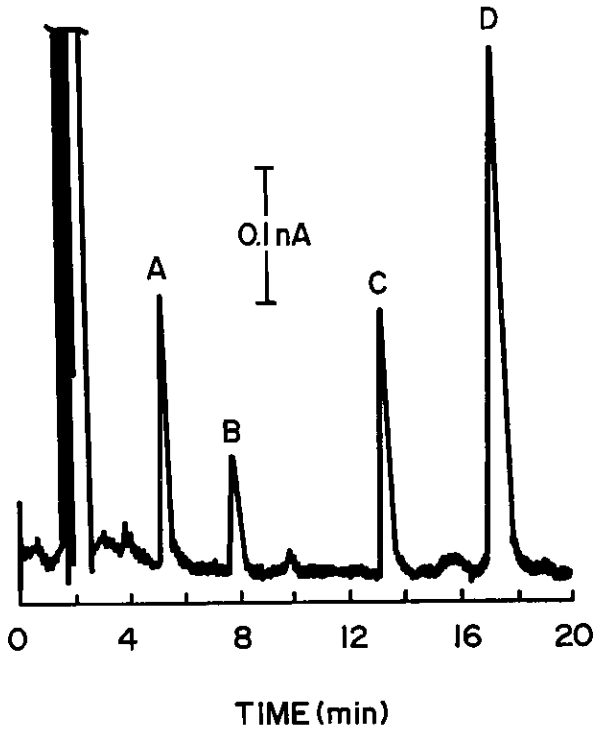

Figure 1. Chromatogram of a sample taken from a boiled polyurethane bag containing 25 mL of water. Peaks A) 2,6-TDA, B) 2,4-TDA, C) aniline, and D) phenol, respectively. Redrawn from above cited reference.

Detection Limit: Less than 1 pmol for each compound
Linear Range: 2,4-TDA, 0.81 pmol - 4.8 nmol; 2,6-TDA, 0.77 pmol - 5.14 nmol; aniline, 0.50 pmol - 2.00 nmol; phenol, 0.52 pmol - 5.24 nmol

Sample Preparation

Commercially available, boilable cooking pouches were filled with 25 mL of distilled-deionized water or buffer, sealed and boiled. A 100 µL sample was then directly injected into the chromatographic system.

Note

There has been concern about the potentially harmful effects of direct exposure of the public to 2,4-TDA, and 2,6-TDA, aniline, and phenol. With the availability and general acceptance of boilable cooking bags, it is necessary to determine those chemicals that can migrate from the polyurethane film into the contents of the bag. LCEC provides a simple, direct approach with low detection limits for the determination of some of these chemicals.

The information in this publication is supplied as a service to our customers. Performance of the methodology has not necessarily been verified by BAS technical staff.