CAPSULES
preliminary notes and applications from Bioanalytical Systems, Inc.

Determination of Diisocyanate Monomers in Air

Purpose

Isocyanates are used extensively in the production of foams, polyurethane paints and adhesives, but are highly toxic and can cause respiratory distress in very low concentrations in air. In the U.S., the National Institute for Occupational Safety and Health (NIOSH) has established strict limits for the concentration of isocyanates, and hence there is a need for a sensitive and accurate method for determination of isocyanates.

Reference

Determination of Diisocyanate Monomers in Air by Differential-Pulse Polarography, G. Corbini, P. Corti, E. Dreassi, L. Nucci and G. Sciarra, Analyst 116 (1991) 731-734.

Method

Isocyanates are highly reactive and hence must be derivatized immediately upon collection. In this study, air was passed through a series of three filters that had been impregnated with 4-nitro-N-propylbenzylamine (the derivatizing reagent), and the monomers were trapped as ureido derivatives (F1). The filters were then extracted using organic solvents, and the solutions were analyzed using differential pulse polarography (the redox process of interest was the reduction of the nitro groups).

$$O{=}C{=}N{-}R{-}N{=}C{=}O + 2HN< \rightarrow >N\text{-}OC\text{-}HN\text{-}R\text{-}NH\text{-}CO\text{-}N<$$

Figure 1. Derivatization reaction.

Results

The quantitative measurement of concentrations using differential pulse polarography is generally based on the relationship between the peak current and the concentration. However, this approach cannot be used for the analysis of the individual ureido derivatives, since the similarity of their redox potentials does not allow adequate resolution; that is, only one peak was observed for a range of mixtures of the ureido derivatives. However, it was found that the peak *area* was proportional to the *total* concentration of ureido derivatives, but this was adequate since official tests require only the *total* isocyanate concentration.

Forty air samples containing different mixtures of various isocyanates were analyzed using both differential pulse polarography and HPLC (for comparison). The two sets of results were linearly correlated, with a correlation coefficient of 0.9979; that is, the polarographic method was a viable alternative to the HPLC method.