Methods for Air Monitoring of Aliphatic Isocyanates

The preferred methods for determining the isocyanate concentration in the air at the workplace are derivatization methods. A suitable reagent is used to convert the isocyanate into a stable derivative. This can then be identified and quantified by chromatography. This principle is used in a variety of methods which differ for instance with regard to quenching agent or sampling technique.

An overview about relevant analytical methods for chemical agents at workplaces is given at http://www.hvbg.de/e/bia/gestis/analytical_methods/index.html.
This website is provided by several European industrial hygiene authorities.
Methods for HDI- and IPDI-based products can be found at:
http://bgia-online.hvbg.de/AMCAW/substance/methoden/110-L-HDI.pdf
and http://bgia-online.hvbg.de/AMCAW/substance/methoden/056-L-IPDI.pdf

The following methods are also well established and widely used for monitoring of aliphatic isocyanates:

Hexamethylene diisocyanate, 2,4- and 2,6-Toluene diisocyanate, DFG Method No. 2, Analytische Methoden, Luftanalysen, Vol 1, consignment 1988[1] - Impinger (solution of N-4-Nitrobenzyl-N-n-propylamine hydrochloride (Nitro reagent) in toluene) or glass fiber filters coated with N-4-Nitrobenzyl-N-n-propylamine hydrochloride (Nitro reagent)

Polyisocyanates based on aliphatic diisocyanates, DFG Method No. 1, Analytische Methoden, Luftanalysen, Vol 1, 8. consignment 1993[2] - glass fiber filters coated with N-4-Nitrobenzyl-N-n-propylamine hydrochloride (Nitro reagent)

OSHA 42[3] - glass fiber filters coated with 1-(2-pyridyl)piperazine (1-2PP)

Various portable or stationary instruments are available for the continuous measurement of isocyanates in the air. All of them function on the principle of colorimetric evaluation of an indicator paper strip. They are operating continuously and unattended. Paper tape systems are easy to use and do not require skilled analysts to operate them. They give rapid results and are therefore suitable for leak detection and in emergency situations. However, they may read incorrect at very high or very low humidity, are unsuitable for aerosols and may not be accepted for purposes of regulatory compliance.

[1] The method of The Deutsche Forschungsgemeinschaft DFG (German Research Foundation) can be found on the website of Wiley-VCH at http://www.wiley-vch.de/publish/en/

[2] The method of The Deutsche Forschungsgemeinschaft DFG (German Research Foundation) can be found on the website of Wiley-VCH at http://www.wiley-vch.de/publish/en/

[3] The method can be found on the website of Occupational Safety and Health Administration OSHA at http://www.osha.gov/dts/sltc/methods/index.html

Useful websites for instruments and equipment are:

http://www.anachem.co.uk/
http://www.draeger.com/index.html
http://www.scottbacharach.com/
http://www.skcltd.com/
http://www.zelana.com/staticPages/ProductSolutions.aspx

Air monitoring of isocyanates requires sound analytical knowledge. In order to obtain reliable results only laboratories with experience in that specific area should be engaged with such measurements.

In Germany, a list of independent measuring institutes that are approved to perform workplace analyses is published by the Federal Ministry of Labor and Social Order (http://www.dar.bam.de/).

DISCLAIMER: The listed methods and links to suppliers of devices are illustrative and are not intended to be an endorsement of any particular method nor a warranty on the effectiveness or fitness for a particular purpose of any listed device or method.