IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

0329

Focus on IFA's work

Edition 12/2011

617.0-IFA:638.1

Sulphuric acid at workplaces: comparison between thoracic and inhalable aerosol fractions

Problem

Sulphuric acid is the most important inorganic acid in numerous technical processes. It is used for example as battery acid in lead-acid batteries, in the production of titanium dioxide, in the anodizing of aluminium, and in galvanic processes. At the end of 2009, the European Commission published a limit value for sulphuric acid of 0.05 mg/m³ when measured as the thoracic particle fraction. So far, sulphuric acid had been measured in the inhalable particle fraction. The commission for working agents of the DFG (MAK Commission) has published an atmospheric limit value of 0.1 mg/m³ for this purpose.

Until now, no suitable sampling system was available for the measurement of thoracic sulphuric acid mist. Comparative parallel measurements were not therefore possible. Such measurements were however desirable in order to facilitate definition of limit values during transposition of the European Commission's value in Germany in the AGS Committee for Hazardous Substances.

Activities

For measurement of the thoracic particle fraction, six examples of the IFA's "10 l cyclone" were first fabricated from sulphuric acid-proof high-grade steel (V4A type 1.4404). This cyclone type has the required collection properties (PM_{10}) at a volumetric flow of 5.34 l/min.

High-grade steel IFA 10 l cyclone

For comparison of the particle masses in the thoracic and inhalable fractions, 47 measurements were performed with the cyclone and the GSP system in 20 companies and different areas of application. Each of the parallel measurements was performed by means of a stationary and duplicated test arrangement and in the vicinity of the emission source.

Results and Application

Low quantities of sulphuric acid aerosol (< 0.01 mg/m³) in working areas (e.g. battery charging, production of sulphuric acid) give rise to only small differences between the thoracic and inhalable particle fractions. These are generally closed systems from which droplets can be emitted only through a small ventilation aperture.

Larger droplets have a decisive influence upon the measured values when for example they can be created through the formation of bubbles in open systems (such as tank formation of lead-acid batteries, copper electrolysis, anodizing of aluminium, production of titanium dioxide). At measured values of > 0.01 mg/m³, larger droplets, which are detected only in the inhalable fraction, account for more than half of the overall sulphuric acid exposure.

A relationship between the thoracic and the inhalable particle fractions was derived for concentrations above 0.005 mg/m³ for the thoracic fraction.

For the AGS Committee for Hazardous Substances, this means that the limit values of the EU and those of the MAK Commission represent a comparably high level of protection.

Area of Application

All German Social Accident Insurance Institutions; companies in which sulphuric acid is used. AGS Committee for Hazardous Substances

Additional Information

- Breuer, D.; Heckmann, P.; Gusbeth, K.; Engel, C.; Schwab, G.; Blaskowitz, M.; Moritz, A.: Schwefelsäure an Arbeitsplätzen – Vergleichsmessungen der thorakalen und einatembaren Aerosolfraktionen zur Umsetzung des IOELV. Gefahrstoffe – Reinhalt. Luft 71 (2011) No 9, pp. 382-388

- Breuer, D.; Heckmann, P.; Gusbeth, K.; Engel, C.; Schwab, G.; Blaskowitz, M.; Moritz, A.: Sulphuric acid at workplaces – applicability of the new IOELV to thoracic particles. J. Environm. Monitoring 14 (2012), pp. 440-445

Expert Assistance

IFA, Division 2: Chemical and biological hazards

Literature Requests

IFA, Central Division

Published and printed by:
Deutsche Gesetzliche Unfallversicherung e. V.
(DGUV), Mittelstraße 51, 10117 Berlin, Germany

ISSN (online): 2190-006X
ISSN (print): 2190-0051

Edited by: Dr Dietmar Breuer
Institut für Arbeitsschutz der Deutschen
Gesetzlichen Unfallversicherung (IFA)
Alte Heerstraße 111, 53757 Sankt Augustin, Germany
Phone: +49 2241 231-01/Fax: -2234
E-mail: ifa@dguv.de, Internet: www.dguv.de/ifa