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Biological monitoring of ortho-toluidine in occupational exposure

L. LABAT[1], J. THOMAS[1], B. DEHON[1], L. HUMBERT[1], B. LELEU[2], C. NISSE[3], M. LHERMITTE[1]

1 Laboratoire de Toxicologie et Génopathies, CHRU de Lille, France

2 Sita Agora, Noyelles Gaudolt, France

3 Service de Pathologie Professionnelle et Environnement, CHRU de Lille, France

AIMS: Ortho-toluidine is an aromatic amine, recognized by the CIRC with human carcinogenic potential with a classification in 2B group (or second category in CEE classification) [1]. It can easily be absorbed through the intact skin and be eliminated in urine as unchanged form. Its urine determination allows biological monitoring in occupational exposure. In France, in the Nord-Pas-de-Calais region, a company initiated destruction of an old industrial site. Workers were employed in demolition of a liquid SO2 plant polluted with ortho-toluidine, which has been stopped twenty years ago.
We propose a simple and fast method in gas chromatography mass spectrometry for biological monitoring of ortho-toluidine of these workers employed in demolition of the plant polluted.

METHODS: Urine samples were collected during exposure for some workers or pre-shift and post-shift for other workers. Determination of ortho-toluidine has been realised in GC-MS [2]. After extraction, derivatisation with anhydrous pentafluoropropionic acid is achieved on samples added with internal standard (ortho-toluidine D9). Chromatographic separation is performed on a BPX5MS column (SGE). Detection is performed with mass spectrometry with NCI with methane. Acquisition is performed in single ion monitoring with 233 ion (m/z) and 213 ion (m/z) used for identification and 233 ion (m/z) used for quantification.

RESULTS: Linearity of the method was verified between 0.1 and 100 µg/L and the limit of detection was 0.02 µg/L. Repeatability and intermediate fidelity were satisfactory (CV<9%). For workers during exposure, urinary concentrations of ortho-toluidine were ranged between 7.66 and 225.12 µg/g of creatinine. After reorganization of work, urinary concentrations at post-shift were still elevated with values ranged between 64.64 and 586.85 µg/g of creatinine for concentrations between 0.19 and 2.46 µg/g of creatinine at pre-shift (n = 6 workers). New collective and individual technical preventive actions more strict allowed diminution of urinary concentrations until values ranged between 2.35 and 20.11 µg/g of creatinine at post-shift and values between 0.22 and 0.34 µg/g of creatinine at pre-shift (n = 4 workers).

CONCLUSION: No biological reference for ortho-toluidine in occupational exposure is recommended. This study shows that the biological monitoring of this amine in this old industrial site allow estimation of efficiency of preventive actions during occupational exposure. More, numerous determinations measured in pre-shift for unexposed workers allow description of new values of this biological marker in unexposed cases.
This new GC-MS method is specific and sensitive and the results show that this method is suitable for biological monitoring of ortho-toluidine as much for unexposed workers as for exposed workers.

REFERENCES:

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Corresponding author: l.labat@chru-lille.fr