

EXPOSURE ASSESSMENT TO TOLUENE IN A CHEMICAL INDUSTRY – COMPLEMENTARITY BETWEEN AIR MONITORING AND BIOMONITORING DATA

Miguel Barros^{1*} and Susana Viegas^{2,3}

¹Escola de Tecnologias e Engenharia, Instituto Superior de Educação e Ciências, Lisboa, Portugal; ²H&TRC - Health & Technology Research Center, ESTeSL- Escola Superior de Tecnologia da Saúde, Instituto Politécnico de Lisboa, Lisboa, Portugal;

³Centro de Investigação e Estudos em Saúde Pública, Escola Nacional de Saúde Pública, ENSP, Universidade Nova de Lisboa, Portugal

*Presenting author: lm.debarros@gmail.com

Toluene is a substance commonly used in the chemical industry. It is a volatile organic chemical and workers exposure occurs frequently by inhalation. The major metabolic pathway of toluene metabolism in humans involves sidechain oxidation by sequential action of cytochrome P-450, alcohol dehydrogenase and aldehyde dehydrogenase leading to benzoic acid which, upon conjugation with glycine, results in hippuric acid, the major urinary metabolite, has long been considered a biomarker of exposure. Toluene affects the central nervous system, eyes, skin, respiratory system, liver and kidneys. Exposure to high levels of toluene during pregnancy has been shown to result in children with birth defects and to retard mental abilities and growth and there is evidence that exposure to toluene is associated with spontaneous abortion. The objective of this study was to evaluate the occupational exposure to toluene in workers in a chemical manufacturing industry of polymers, recognize the main factors influencing exposure and identify measures to prevent workers exposure. Exposure assessment was done with air monitoring and biomonitoring. Air monitoring was done in 2 shifts, of a total of 4, through active sampling and GC-FID analysis (LoD= 0.7 µg and LoQ= 9.0 µg). Additionally, volatile organic compounds (VOCs) were also measured with a photocatalytic sensor of 10.6 eV. Biomonitoring was also used and all the workers exposed to toluene (n= 20) participate. For this, urine samples were collected before and after the 8-hour shift and hippuric acid was measured (LoD= 0.1 g/L). Student's t-test for paired samples and Pearson's correlation test were applied. All the values obtained were below the occupational exposure limits present in the Portuguese Standard NP 1796:2014 reference value (20 ppm). However, VOCs results showed high concomitant exposure during the entire working period. 65% of workers showed an increase in the concentration of hippuric acid in urine after work shift. Statistically, the increase in hippuric acid excretion is due to occupational exposure to toluene, with 85% confidence. It was also observed a correlation of 0.4 (positive correlation) between both types of monitoring. In conclusion, exposure is related with specific tasks and is characterized by being high only during those tasks and depending how the tasks are performed. There is a need for exposure control measures, such as the implementation of closed/automatized systems in tasks where toluene is handled by workers or, alternatively, local exhaust ventilation, dedicated to the filling operations. Air monitoring and biomonitoring data were useful, and both allowed different conclusions and support different preventive and protective measures.