Contribution ID: **64** Type: **Poster**

Exposure to hardwood dust: chemical-physical characterization and study of particle distribution dynamics during a cutting simulation

In the wood processing industry, exposure to dust is one of the major potential health threats for workers. During sawing, high concentrations of particles of different sizes are generated. They are potentially harmful for human health and exposed workers can report occupational diseases such as allergic rhinitis, chronic bronchitis, lung fibrosis, asthma, nasal and sinonasal cancers. The issue has been studied extensively in the past by several authors (1-4); such studies (and others) have led to definition of guidelines and regulations by the international occupational safety and health community.

In 1999 the European Union Directive 1999/38 has classified hardwood dusts as carcinogenic and has set the occupational exposure limit for hardwood dust to 5 mg/m3 of inhalable dust of workplace air. In 2004 the European standard EN 12779 set a recommendation of 0.2 mg/m3 as a weighted average concentration for residual dust, while the ACGIH, in 2007, fixed TLVs at 0,5 mg/m3 (inhalable fraction) for western red cedar and at 1 mg/m3 (inhalable fraction) for all other wood species by classifying oak and beech dust in carcinogenicity category A1 (confirmed human carcinogen) and birch, mahogany teak and walnut in category A2 (suspected human carcinogen) and all other wood dusts in category A4 (not classifiable as human carcinogen). Finally, European legislation recently set the limit value at 2 mg/m3 as referred to 8 h working (Directive (EU) 2017/2398).

Further studies have also highlighted the importance of the size of dust produced during sawing, which plays a key role in the occurrence of professional diseases that can penetrate into the alveolar region and enter the blood circulation system (5). In a study by Marta Pedzik et al. (6) ultrafine dusts of 6 different types of hardwoods (black alder, European ash, common walnut, pedunculate oak, hornbeam and European beech) were investigated. Moreover, the authors reported that European beech showed the smallest particle size, less than 2.5µm, and the difference between the particle size of European beech dust and the other dusts was found to be statistically significant in contrast to the amount of dust generated by the other woods. The study concludes by stating that all hardwood species studied should be equally considered a source of serious occupational risk to woodworkers.

UFPs contribute in a small fraction to the mass concentration of wood dust and are therefore largely overlooked when focusing on TLVs for occupational exposure assessment which are based on mass concentration. Gu et al. (7) states that the current mass-based occupational exposure limit for wood dust can not reveal the high exposure to UFP and particle diameters less than 10 µm.

In the present study, sawing products of commercial plywood poplar in a test-controlled chamber isolated from other emission sources, were investigated. Chemical-physical analysis of as- produced particles and the dynamics of the corresponding size distributions were characterized.

Real-time measurements (particle number concentration, particle size distribution and Lung Deposited Surface Area) and SEM investigations allowed us to characterize the simulated exposure scenario compared to the background

During sawing the highest PNC value related to particle size less than 2.5 µm is lower than 400 times if compared to maximum PNC value for particles in the size range from 5.6 to 560 nm that reached the maximum value of 1x10 E6 part/cm3 (higher 100 times than the background mean value). The Lung Deposited Surface Area for particles in the size range from 10 to 1000 nm has shown mean value 2 times higher than mean background value.

In conclusion, the study showed that the TLV based on particle mass concentration underestimates the contribution to occupational risk assessment during woodworking activities because of high PNC values generated in the submicrometric size range.

(1) Enarson, D.A., and M. Chan-Yeung: Characterization of health effects of wood dust exposures. Am. J. Ind.

Med. 17:33–38 (1990).
(2) Dahlqvist, M., L. Palmberg, P. Malmberg, B.M. Sundblad, U. Ulfvarson, and W. Zhiping: Acute effects of exposure to air contaminants in a sawmill on healthy volunteers. Occup. Environ. Med. 53(9):586–590 (1996).
(3) Demers P.A., K. Teschke, and S.M. Kennedy: What to do about softwood? A review of respiratory effects and recommendations regarding exposure limits. Am. J. Ind. Med. 31:385–398 (1997).
(4) Alonso-Sardon, M., Chamorro, A.J., Hernandez-Garcia, I., Iglesias-de-Sena, H., MartinRodero, H., Herrera, C., et al.,. Association between occupational exposure to wood dust and cancer: a systematic review and meta-analysis. PLoS One 10, 2015. https:// doi.org/10.1371/journal.pone.0133024.
(5) Oberdörster, G., Oberdörster, E., Oberdörster, J., 2005. Nanotoxicology: an emerging discipline evolving from studies of ultrafine particles. Environ. Health Perspect. 113, 823–839. https://doi.org/10.1289/ehp.7339
(6) Marta P¸edzik , Tomasz Rogozinski, Jerzy Majka, Kinga Stuper-Szablewska, et al. Fine Dust Creation during Hardwood Machine Sanding. Appl. Sci., 11, 6602, 2021. https://doi.org/10.3390/app11146602
(7) J. Gua, I. Kirscha, T. Schrippa, F. Froning-Ponndorf, et al. Human exposure to airborne particles during wood processing. Atmospheric Environment 193 101–108, 2018. https://doi.org/10.1016/j.atmosenv.2018.08.064

Primary author: FERRANTE, Riccardo (1Italian Workers'Compensation Authority, Department of Occupational and Environmental Medicine, Epidemiology and Hygiene, Via Fontana Candida 1, I-00078 Monte Porzio Catone, Rome, Italy)

Co-authors: BOCCUNI, Fabio (1Italian Workers'Compensation Authority, Department of Occupational and Environmental Medicine, Epidemiology and Hygiene, Via Fontana Candida 1, I-00078 Monte Porzio Catone, Rome, Italy); CLAUDIO, Natale (2Istituto Italiano Di Tecnologia, Nanoregulatory Group, D3PharmaChemistry, Genova, Italy); SEBASTIANI, Francesca (3Sapienza University of Rome, I-00184 Rome, Italy); CICCIOLI, Paolo (Consiglio Nazionale delle Ricerche, Istituto per la Bioeconomia (CNR-IBE), Bologna, Italy); PIZZO, Benedetto (Consiglio Nazionale delle Ricerche, Istituto per la Bioeconomia (CNR-IBE), Sesto Fiorentino, Firenze, Italy); TOMBOLINI, Francesca (1Italian Workers'Compensation Authority, Department of Occupational and Environmental Medicine, Epidemiology and Hygiene, Via Fontana Candida 1, I-00078 Monte Porzio Catone, Rome, Italy)

Presenter: FERRANTE, Riccardo (1Italian Workers'Compensation Authority, Department of Occupational and Environmental Medicine, Epidemiology and Hygiene, Via Fontana Candida 1, I-00078 Monte Porzio Catone, Rome, Italy)