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Respirable Dust Exposure and Psychosocial Stress Among Sanding and Spray-Painting Workers: A Pilot Study

Ahmad Iskandar Firdaus Ahmad Rahiza[a] & Nurul Latiffah Abd Rani[a*]

Structured Abstract

Background: Sanding and spray-painting generate airborne particulate matter during surface preparation and coating processes. Tasks involving visible dust and time-pressured work may influence workers' perceptions of exposure and workplace safety, acting as psychosocial stressors. While chemical exposure monitoring provides objective data on airborne dust levels, limited studies have examined respirable dust exposure in relation to psychosocial factors in these work environments. This study aimed to assess respirable dust exposure and psychosocial factors among sanding and spray-painting workers.

Methods: A cross-sectional study was conducted at Composites Technology Research Malaysia (CTRM) Aero Composites Sdn. Bhd. involving six workers engaged in sanding and spray-painting activities, representing two Similar Exposure Groups. Respirable dust was assessed using personal gravimetric air sampling in accordance with NIOSH NMAM 0600, including 8-hour time-weighted average (TWA) and task-based sampling. Psychosocial conditions were evaluated using DASS-21 and PSS-10 questionnaires, supported by workplace observations.

Results: Eight-hour time-weighted average (TWA) respirable dust concentrations measured among sanding workers ranged from 4.76 to 8.60 mg/m³, exceeding the reference permissible exposure limit of 3.0 mg/m³. In comparison, spray-painting workers recorded lower TWA concentrations ranging between 1.67 and 2.92 mg/m³, which remained below the reference limit. Task-based sampling indicated markedly elevated short-term respirable dust concentrations for both activities, with sanding tasks ranging from 25.58 to 41.32 mg/m³ and spray-painting tasks ranging from 23.61 to 31.48 mg/m³. Psychosocial assessment using DASS-21 and PSS-10 questionnaires indicated varying levels of stress, anxiety, and perceived stress among workers, with higher scores observed among individuals involved in tasks associated with elevated respirable dust concentrations.

Conclusion: Sanding operations were associated with higher respirable dust exposure compared to spray-painting activities. Although spray painting demonstrated lower average exposure levels, elevated short-term concentrations were observed during task-based activities. These findings highlight the importance of task-specific exposure assessment and the consideration of psychosocial factors when evaluating working conditions in sanding and spray-painting environments.

Keywords: Respirable dust, Chemical exposure monitoring, Psychosocial factors, Sanding, Spray painting

*Correspondence: nurullatiffah@uitm.edu.my

[a] School of Chemistry & Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia