Establishing a Surrogate Approach to Assess the Exposure Concentrations during Coating Process

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Abstract : A surrogate approach was deployed for assessing exposures of multiple chemicals at the selected working area of coating processes and applied to assess the exposure concentration of similar exposed groups using the same chemicals but different formula ratios. For the selected area, 6 to 12 portable photoionization detector (PID) were placed uniformly in its workplace to measure its total VOCs concentrations (CT-VOCs) for 6 randomly selected workshifts. Simultaneously, one sampling strain was placed beside one of these portable PIDs, and the collected air sample was analyzed for individual concentration (CVOCi) of 5 VOCs (xylene, butanone, toluene, butyl acetate, and dimethylformamide). Predictive models were established by relating the CT-VOCs to CVOCi of each individual compound via simple regression analysis. The established predictive models were employed to predict each CVOCi based on the measured CT-VOC for each the similar working area using the same portable PID. Results show that predictive models obtained from simple linear regression analyses were found with an R2 = 0.83~0.99 indicating that CT-VOCs were adequate for predicting CVOCi. In order to verify the validity of the exposure prediction model, the sampling analysis of the above chemical substances was further carried out and the correlation between the measured value (Cm) and the predicted value (Cp) was analyzed. It was found that there is a good correction between the predicted value and measured value of each measured chemical substance (R2=0.83~0.98). Therefore, the surrogate approach could be assessed the exposure concentration of similar exposed groups using the same chemicals but different formula ratios. However, it is recommended to establish the prediction model between the chemical substances belonging to each coater and the direct-reading PID, which is more representative of reality exposure situation and more accurately to estimate the long-term exposure concentration of operators.

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