

Investigation of In-vehicle Air Pollutants Levels and A Predictive Model for Vehicle Air Exchange Rates: Case Study of Tehran, Iran

Marzieh Makaremi¹

Fereshteh Ghomi Avili²

Abstract

People are exposed to high level of particulate matter (PM) and gaseous contaminants in different indoor and outdoor environments. An irrefutable route of exposure to traffic-related pollutants is in-vehicle microenvironment which has brought adverse human health effects in recent years. This study entails measurement of in-cabin air quality and predicting mathematical models for calculating in-vehicles Air- Exchange-Rate (AER). Concentrations of particulate matter number, particulate matter mass and carbon monoxide (CO) were measured simultaneously in various condition (i.e., vehicle type, ventilation, and speed) in a highway and tunnel. The results indicate that the average pollutants concentration in the tunnel was higher than that of the highway. This figure was seven times higher when all windows of cars were open compared to the experiments with closed windows and air conditioner on. In addition, the maximum level of CO gas was 40 ppm measured in the tunnel while windows were open. The aim of this study is to develop models for predicting AER model in three vehicles when all windows are open under various ventilation settings and driving speeds. The mass balance equation has been applied to the concentration of CO₂ gas as a tracer to measure AER in vehicles. The predicted equation when all windows were open have a strong correlation between the measured and the predicted AER under the same condition ($R^2=0.80$).

Keywords: Highway, Tunnel, in-vehicle, PM, CO, Air-Exchange-Rate

¹ PHD In Environmental Engineering, (makaremi20@yahoo.com)

² Department of civil engineering Noshahr, Islamic Azad University of Noshahr,Iran, (fghomi@yahoo.com)