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Influence of temperature variability on the efficacy of negative ions in removing particulate matter and pollutants: an experimental database

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Abstract-

Cities globally must make urgent decisions to ensure a sustainable future as rising pollution, particularly PM2.5, poses severe health risks like respiratory and heart diseases. PM2.5’s harmful composition also impacts vegetation and the environment. Immediate government intervention is necessary to mitigate these effects. This study tackles the urgent problem of reducing PM2.5 levels in Medellín’s urban and indoor environments, where pollution presents serious health risks. To explore effective solutions, this research provides new data on the interaction between particulate matter from various pollutants and negative ions under different temperature conditions, offering valuable insights into air quality improvement strategies. Using a high-voltage system, ions bind to pollutants, accelerating their removal. Experiments measured temperature, humidity, formaldehyde, volatile organic compounds, negative ions, and PM2.5 in a 40 cm3 chamber across various conditions. Pollutants tested included cigarette smoke, incense, charcoal, and gasoline at two voltage levels and three temperature ranges. The data, available in CSV format, were based on 36,000 samples and repeated tests for reliability. This resource is designed to support studies investigating particulate matter control in urban and indoor environments, as well as to improve our understanding of negative ion-based air purification processes. The data are publicly available and structured in formats compatible with leading data analysis platforms.

Index Terms- air quality; particulate matter; ionization technology; electrostatic recombination; ion–particle interaction database

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