Determination of Factors that Impact Clearance of Suspended Particulate Matter (Dust) in Air

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Environmental dust causes multiple problems, including negative effects on human health, impairment of machinery operation, and production of sensitive electronic components. Multiple types of interventions have been used to reduce amounts of dust, including filtering the air and alteration of local atmospheric conditions. I hypothesized that filtering would provide the most effective decrease in atmospheric dust, while changes in local humidity, temperature, or ionic charges would be less effective. To test this central hypothesis, I designed and built a portable microprocessor controlled dust meter, with sensors to also measure temperature, humidity, time, and location. Dust levels in different parts of Rochester, MN were determined to identify areas with higher dust concentrations. To analyze effects of atmospheric conditions, dust from smoke was monitored in a controlled environment. Burnt out matches deposited in an airtight aquarium provided a consistent source of suspended particles. Rates of dust decay over time were determined under conditions of varying humidity, temperature, and ionic charge potential. I found that dust levels decayed at exponential rates that were highly reproducible. I also tested the abilities of several materials to filter out dust particles. Surprisingly, one of the most effective conditions that removed suspended particulate matter was the generation of negative ions. Finally, a compact personal dust detector was designed and built, and demonstrated to be able to detect different levels of dust. This methodology may be useful for detecting and ensuring rapid responses to dangerous atmospheric conditions at low cost to improve health and prevent damage to machinery.

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Third Award of $1,000