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Tang M, Siegel JA, Corsi RL, Novoselac A. 2022. Evaluation of Ozone Removal Devices Applied in Ventilation Systems. *Building and Environment, **225**, 109582. DOI:* https://doi.org/10.1016/j.buildenv.2022.109582.

Abstract

Applying ozone removal devices in ventilation systems is an effective way to reduce building occupant exposure to ozone. However, little is known about the performance of commercially-available ozone removal devices under realistic usage conditions, especially for technologies that have recently emerged for general ventilation such as ultraviolet photocatalytic oxidation (UV–PCO) and catalysis (without UV). A total of 14 ozone removal devices that are representative of products on the market were selected: 11 activated carbon filters, 2 UV-PCO devices, and 1 catalyst filter without UV. We tested these devices with an "ozone stress test" by exposing them to 70 ppb, 107 ppb, and 500 ppb of ozone at 25 °C, 50% RH, and 2.5 m/s face velocity. The device performance was evaluated by the average efficiency at each ozone level, degradation rate at 500 ppb, pressure drop, and a quality factor that combines efficiency and pressure drop. Results show a wide range of single-pass removal efficiency from 3% to 93% at 70 ppb. All devices degraded at a slow rate; at 500 ppb, most devices degraded at 1.5%/h relative to their efficiency at the beginning of this period. The catalyst (no UV) and three 12 inch activated carbon devices achieved high efficiency at the least cost of pressure drop. The loading and source of carbon had a significant impact on the efficiency of activated carbon filters. A two-fold increase in carbon loading led to nearly a two-fold higher single-pass removal efficiency. Coal-based carbon degraded 20 times faster than coconut shell-based carbon.

Practical Implications

- 14 ozone removal devices utilizing three technologies had a wide performance range.
- Carbon type and loading greatly affected activated carbon removal efficiency.
- Activated carbon removed the majority of ozone in carbon-integrated UV-PCO devices.
- The catalyst (no UV) and 12″ activated carbon devices had highest quality factors.

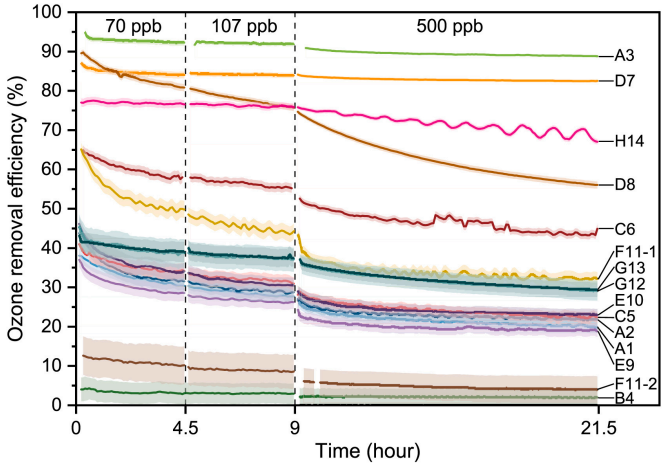

Fig. 2. Averaged efficiency curves of replicates for all test devices during phases 1–3 in the Ozone Stress Test. Shaded areas represent uncertainty of the averaged efficiency of replicates.

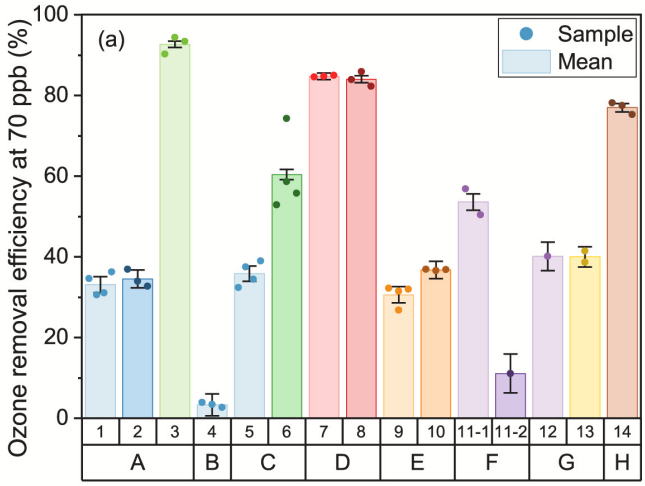

Fig. 3 Time-averaged ozone removal efficiency of all devices during phase 1 (70 ppb ozone for 4.5 h) Dots represent the time-averaged ozone removal efficiency of individual device samples. Columns represent the averaged efficiency of the replicates of the same device type, and error bars represent the uncertainty of the average due to measurement errors.

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