



Siegel JA. 2016. Keynote: Primary and secondary consequences of indoor air cleaners. *Indoor Air*, 26(1), 88-96. DOI: [10.1111/ina.12194](https://doi.org/10.1111/ina.12194)

Abstract

Air cleaning is broadly applied to reduce contaminant concentrations in many buildings. Although diverse in underlying technology, mode of application, target contaminants, and effectiveness, there are also commonalities in the framework for understanding their primary impact (i.e. concentration reductions) and secondary impacts (e.g. energy use and by-product production). Furthermore, both primary and secondary impacts are moderated by the specific indoor context in which an air cleaner is used. This investigation explores the dynamics of removal efficiency in a variety of air cleaners and combines efficiency and flow rate to put air cleaning in the context of real indoor environments. This allows for the direct comparison to other indoor pollutant loss mechanisms (ventilation and deposition) and further suggests that effective air cleaner use is context and contaminant specific. The concentration reduction impacts of air cleaning need to be contrasted with the secondary consequences that arise from the use of air cleaners. This study emphasizes two important secondary consequences: energy use of the air cleaning process and primary and secondary emissions from air cleaners. This study also identifies current research challenges and areas for large leaps in our understanding of the role of air cleaners in improving indoor environmental quality.

Main findings

Effective use of air cleaners requires considerably more knowledge than simply a static contaminant removal efficiency. Removal efficiencies for many air cleaners are **dynamic**, and the removal efficiency needs to be put in the **context** of the system in which the air cleaner is used and the environment in which the air cleaner is deployed. The impacts of an air cleaner are not limited to contaminant removal: Important **secondary impacts** include **energy use** associated with an air cleaner and **by-product emission**.

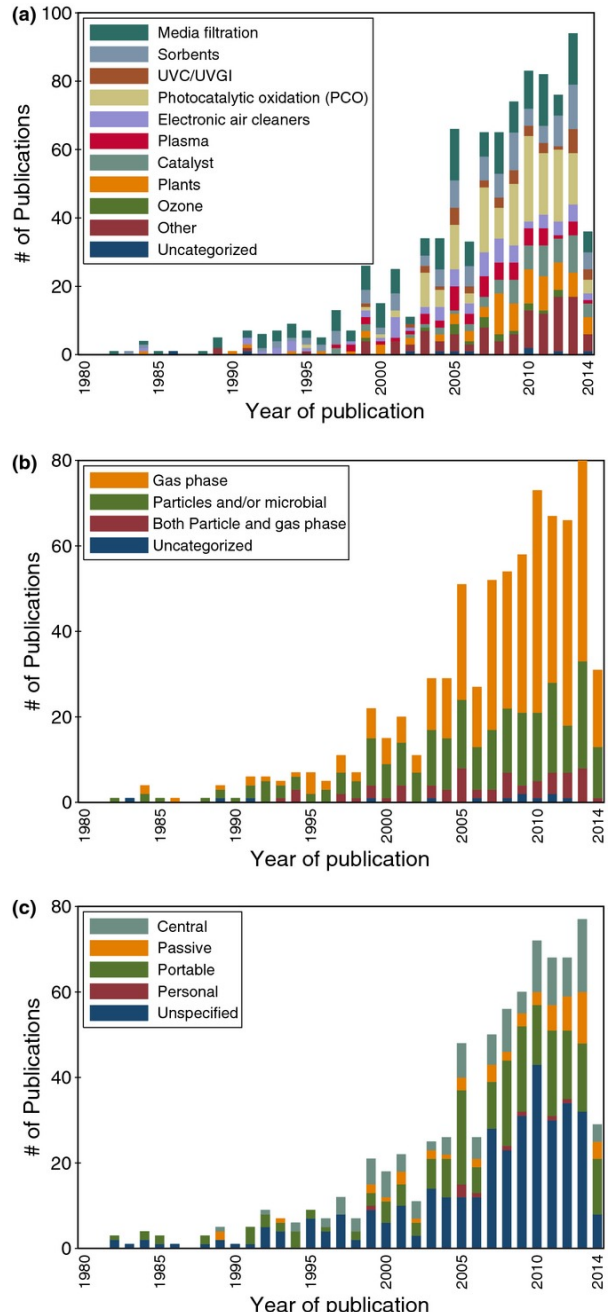


Figure 2. Air cleaner citations in the Science Citation Index as a function of year classified by (a) technology, (b) target contaminant, and (c) scale of air cleaner.

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