Can commonly-used fan-driven air cleaning technologies improve indoor air quality? A literature review

Air cleaning techniques have been applied worldwide with the goal of improving indoor air quality. The effectiveness of applying these techniques varies widely, and pollutant removal efficiency is usually determined in controlled laboratory environments which may not be realized in practice. Some air cleaners are largely ineffective, and some produce harmful by-products. To summarize what is known regarding the effectiveness of fan-driven air cleaning technologies, a state-of-the-art review of the scientific literature was undertaken by a multidisciplinary panel of experts from Europe, North America, and Asia with expertise in air cleaning, aerosol science, medicine, chemistry and ventilation. The effects on health were not examined. Over 26,000 articles were identified in major literature databases; 400 were selected as being relevant based on their titles and abstracts by the first two authors, who further reduced the number of articles to 160 based on the full texts. These articles were reviewed by the panel using predefined inclusion criteria during their first meeting. Additions were also made by the panel. Of these, 133 articles were finally selected for detailed review. Each article was assessed independently by two members of the panel and then judged by the entire panel during a consensus meeting. During this process 59 articles were deemed conclusive and their results were used for final reporting at their second meeting. The conclusions are that: (1) None of the reviewed technologies was able to effectively remove all indoor pollutants and many were found to generate undesirable by-products during operation. (2) Particle filtration and sorption of gaseous pollutants were among the most effective air cleaning technologies, but there is insufficient information regarding long-term performance and proper maintenance. (3) The existing data make it difficult to extract information such as Clean Air Delivery Rate (CADR), which represents a common benchmark for comparing the performance of different air cleaning technologies. (4) To compare and select suitable indoor air cleaning devices, a labeling system accounting for characteristics such as CADR, energy consumption, volume, harmful by-products, and life span is necessary. For that purpose, a standard test room and condition should be built and studied. (5) Although there is evidence that some air cleaning technologies improve indoor air quality, further research is needed before any of them can be confidently recommended for use in indoor environments.

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